

# FLIGHT

The  
AIRCRAFT  
ENGINEER  
&  
AIRSHIPS

First Aero Weekly in the World

Founder and Editor: STANLEY SPOONER

A Journal devoted to the Interests, Practice, and Progress of Aerial Locomotion and Transport

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## Flight

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### DIARY OF FORTHCOMING EVENTS.

Club Secretaries and others desirous of announcing the dates of important fixtures are invited to send particulars for inclusion in the following list:

- May 20 to 30 Pan-American Aeronautic Congress at Atlantic City
- May 23 to 30 Seaplane Contests at Barcelona
- June 22 ... Wilbur Wright Memorial Lecture, H.R.H. Prince Albert presiding, at 8 p.m., at Central Hall, Westminster. Commander J. C. Hunsaker will read a paper on "Naval Architecture in Aeronautics"
- July 9 to 20 S.E.A.C. International Aero Exhibition at Olympia
- July (mid.) Seaplane Contests at Antwerp
- July 24 ... Aerial Derby
- Aug. 3 ... Air Ministry Competition (Large and Small Type Aeroplanes)
- Aug. (end of) Schneider International Race, Venice
- Sept. 1 ... Air Ministry Competition (Seaplanes)
- Sept. ... International aviation week (with competitions) at Brescia, Italy
- Sept. 27 to Oct. 3 Gordon-Bennett Aviation Cup, France
- Oct. 22 ... Gordon-Bennett Balloon Race, Indianapolis, U.S.A.

## EDITORIAL COMMENT



HE Postmaster-General announced in the House recently that he was concerting arrangements with the Dutch Post Office for the establishment of an aerial mail service between this country and Holland, which he hoped would soon be consummated, and that it would also be possible very

shortly to establish a similar service with Belgium.

Regarding the Dutch service, this is now old news, and we have commented upon it previously. The fact that it is hoped to establish a Belgian air route is new (officially), and we welcome it as a further earnest of the fact that the postal authorities of the country are at last awaking to the fact that there really are possibilities of a commercial nature in aviation. It is nevertheless to be regretted that the Post Office is still content to follow the lead given by private enterprise, and does not seem inclined to assume the rôle of pioneer in the opening up of overseas air services. We are fully appreciative of the fact that what the Post Office exists for is to carry the mails in safety and by the quickest possible methods. The business community will forgive a little less than maximum speed so long as its mail matter is delivered with certainty and in safety. Therefore, we can hardly expect that the Post Office should embark in hazardous experiments, even for the sake of helping along an industry which may have demonstrated that it merely has possibilities of future usefulness. But aviation no longer stands in this relation to transport, though it is apparently the view of the postal authorities that it does. It has proved itself to the hilt to be quite as certain, quite as reliable, as any of the older methods of transmission of mail matter. That has been quite sufficiently demonstrated by the wonderful success which has attended the London-Paris and other services which have been in being for the past year or more, and from which the Post Office seems at last to be learning useful lessons, if we are to judge from the announcement of the hoped-for Belgian service. If that does indeed come to pass it will be the first aerial route actually pioneered by our own Post Office—if some private enterprise does not get to actual

work with such a service while the Post Office is making up its mind.

Incidentally, and while we are on the subject of these mail services, we have not heard yet what was the result of the request for tenders for the Dutch service, or whether the strained conditions insisted upon by the Post Office were modified at the eleventh hour.

**The  
Forthcoming  
Aero Show**

From every point of view the Show which will open at Olympia on July 9 will be by far the most interesting and informative that has ever been held in this country, and probably in the world. The interval of six years which has elapsed since the last Show of the kind to be held in the Olympian building has been one of marvellous achievement, and even more wonderful progress in all that makes towards speed, reliability and safety of operation in aircraft. That progress can in no wise be measured merely by the period of time elapsed, because the latter has been extraordinarily prolific of invention and applied research under the intensive influence of a great and bitter war, in which each side struggled for aerial supremacy as it possibly did not exert itself in any other direction. We say this with full appreciation of the fact that the War caused intensive effort in many directions. For example, it brought a terrific struggle to attain an overwhelming superiority in gun power, which again resulted in a concentration of effort to provide more and yet more munitions to feed the guns. Again, the enemy's submarine campaign brought with it a corresponding activity on our own side and that of some of our Allies in shipbuilding to replace the losses caused by that immoral attack on civilisation, while the enemy himself was building hard to make good his losses in under-water craft. But, after all is said and done, the fight to attain aerial supremacy was probably the most strenuous and bitter of all, and almost certainly resulted in more progress being made towards a stage of relative perfection than was the case in any other direction.

It must be borne in mind that when the War began the aerial arm was a veritable infant in swaddling-clothes. Not one of the belligerents had more than a mere nucleus of an air service as we now understand it. Our own case was worse than that of the rest, owing to the policy of wait and see which had been so characteristic of this country's defence preparations. We had few firms beyond the pioneers who could build aircraft at all. Practically none could, or at any rate did, build engines which were comparable to those of France and Germany, and in consequence we were compelled in the first instance to draw our main supplies of aero-motors from our Allies. Nor were the best of these at all comparable to the magnificent engineering productions which were the engines of the late War period. The advances made in engine construction, especially by British constructors, were such that they simply cannot be described in plain words, while the corresponding advance in the material, design and construction of aircraft was just as great.

Neither were these advances peculiar to the aeroplane. As a matter of fact, it is highly probable that when we sit down to review the whole of the aerial history of the War, we shall come to the conclusion that the British constructor progressed to an even greater length in the design and building of the lighter-

than-air types. When the War broke out our airship "fleet" consisted of two or three effective vessels of tiny capacity and low speed, which were hopelessly out-classed by the airships of every one of the belligerent Powers. In comparison with the progress which had been made in airship construction in Germany, our own efforts were puny to the point of being ludicrous. Yet in the five years of war we not only improved our airships all along the line, but even in the construction of giant rigid ships of the super-Zeppelin type we had not only overtaken the enemy but in several essential particulars had actually passed him. There is little doubt that the latest British rigids were superior in speed and airworthiness to the best that Germany had produced. How much of this was due to the shortage of material in the latter country, caused by the Allied blockade, and how much to superior inventiveness and applied genius on the part of our own constructors, we cannot say, but the facts are indisputable.

**The  
Lessons  
Embodied  
in the  
Show**

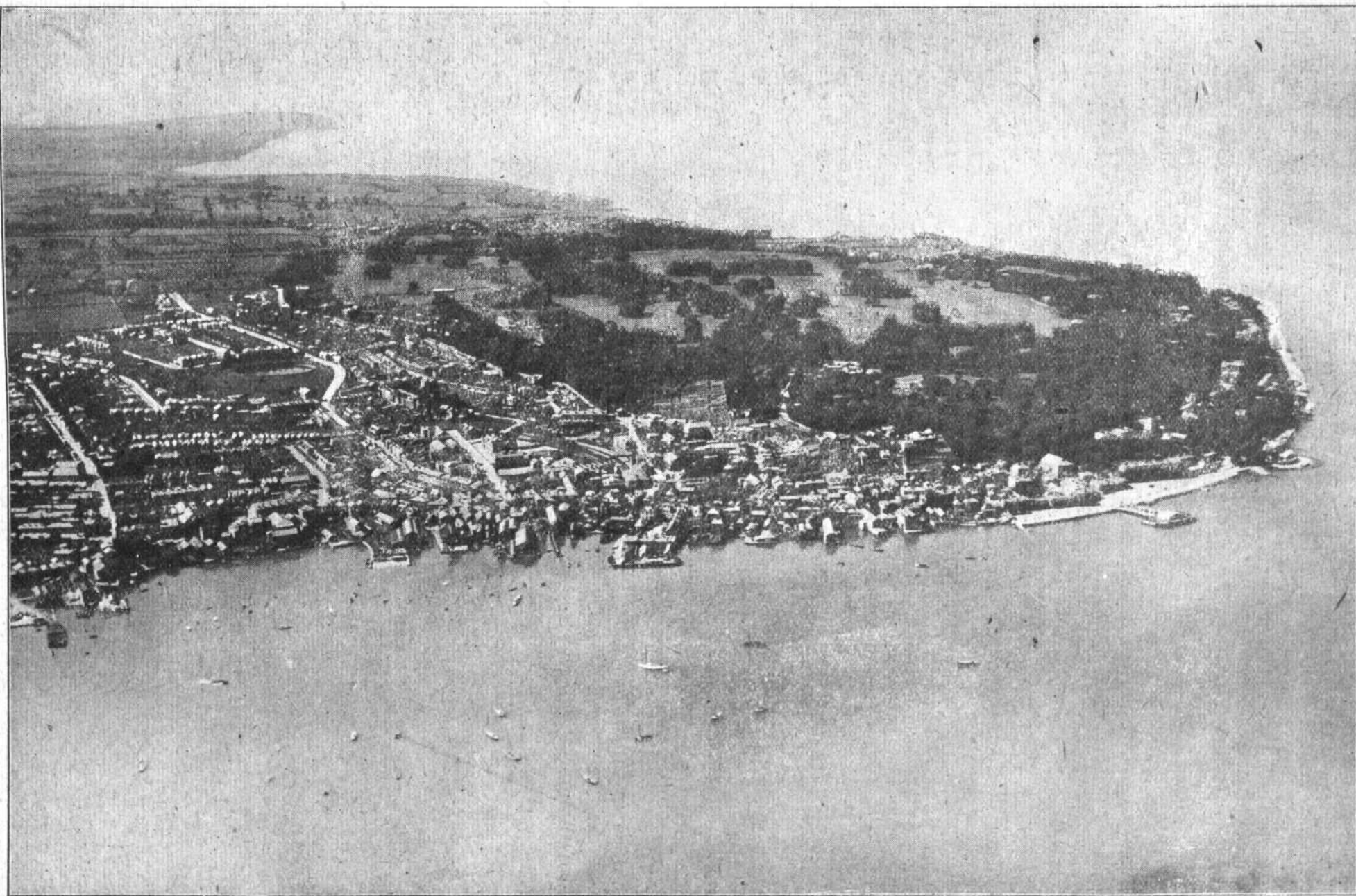
Harking back for a moment to the last Olympia Aero Show, that was practically an exhibition of the experimental, where we could see the striving of inventors to overcome the manifold problems which had to be solved in order that flight might be made practical. It is true that the major problem had been solved. It was solved from the moment the first free flight under power was made. But there still remained an enormous amount of research and its application to be done before we could say that aerial navigation in its broadest sense was actually with us, and he would have been a bold man who would have dared to prophesy that we should stand where we do today within any shorter space of time than a quarter of a century. What has really happened is that we have made the progress of at least twenty years in five under the driving impetus of war for our very existence. All the lessons learned during that bitter period and all the application of those lessons to the navigation of the upper air will be gathered together under the giant roof of Olympia, and to say that the resultant will be one of extraordinary interest is to hopelessly understate the case. By far and away the best, most comprehensive, and superlatively interesting Aero Show in history it will be, and we shall be surprised if the public fail to realise it and to flock to Olympia in its thousands.

**Germany's  
Secret  
Aircraft**

We do not like the repeated suggestions that Germany has been able to keep from the eyes of the Allied Aeronautical Commission a large number of aeroplanes and aeronautical supplies in defiance of the terms of the Treaty of Versailles, reference to which has been so often made in FLIGHT. There may be much or little in the axiom that where there is smoke there is fire, as applied to the present question under discussion, but constant reiteration of the statement cannot but give rise to a feeling of uneasiness. Just before the House rose for the Whitsuntide Recess, Col. Sir Frederick Hall asked the Secretary for Air if, as a result of the long period which elapsed between the armistice and the visits paid by the Commission to the aeroplane and motor works and aerodromes in Germany, the Germans were enabled to secrete a large quantity of important aircraft and machinery. He



MAY 27, 1920



Cowes, Isle of Wight, as seen from a Supermarine Flying Boat

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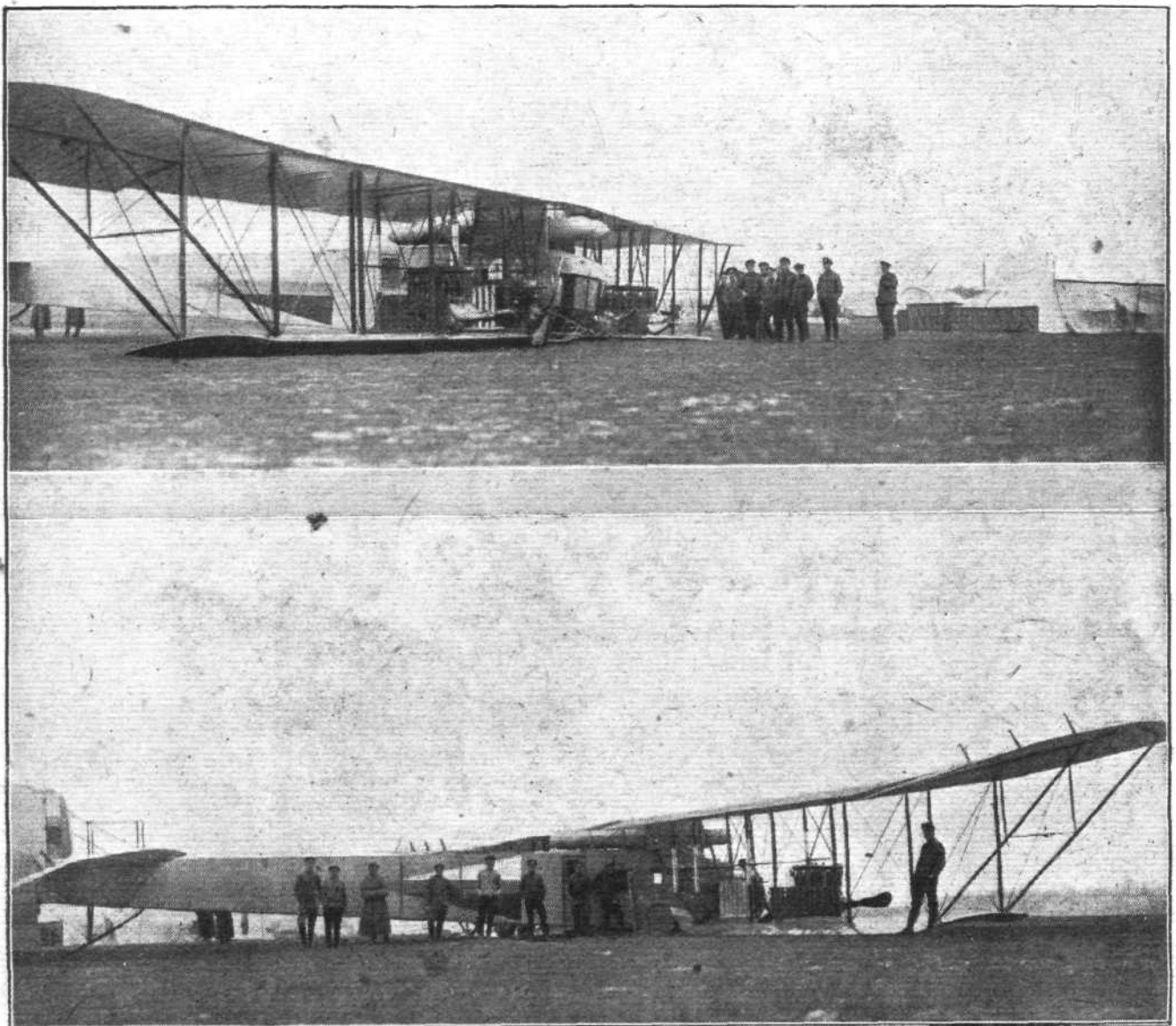
also wanted to know if the inspection by the Commission was made immediately after the armistice, and whether they succeeded in finding the jigs and dies of new classes of aeroplanes.

Mr. Churchill was not at all definite in his replies. He merely said that if his questioner had any information bearing out the suggestion contained in the first part of the question he would be glad to have it communicated to him. Generally, he said, the arrangements under which the disarmament of Germany was being carried out were set forth in the Peace Treaty and so far as these arrangements permitted them, the Allies were acting with the utmost energy. He further pointed out that the whole question of the manufacture of commercial aeroplanes was very closely allied with the manufacture of war machines, and under the Treaty the manufacture of commercial aeroplanes was allowed.

It will be observed that the Air Secretary neither admitted nor denied that secretion of aircraft and machinery has been practised. On the other hand, it is constantly being stated categorically here and in France that it has been successfully carried out. It may be argued that Germany is simply out to protect the future of her commercial aviation, and wants to save as much as possible from the wreck in order to give the industry something like a level start. We ourselves take a more serious view. There is every

warrant, after taking account with the past history of the Hun and his relations with the rest of the world, for the belief that he contemplates revenge for his defeat, and that at the earliest possible moment. At the very least it will be safer for the world to regard him with suspicion, and with the belief that he will strain every nerve to consummate that purpose. Indeed, there are still leading Huns who make no secret of the intention. If they are simply indulging in bombast, so much the worse for their country, for we cannot afford to take them otherwise than seriously. On that assumption, therefore, we can conclude only that if Germany is in fact trying to evade the Treaty by secreting material which would be invaluable to her for *la revanche*, it is for that purpose she is doing so.

We agree that it is not an easy task the Aeronautical Commission has to carry out, and we would not desire to make it heavier were it not that the matter is much too serious to be dismissed as lightly as Mr. Churchill did in his replies to Sir Frederick Hall. There must be ways and means of finding out whether there is truth or not in the repeated reports which are current. If there is nothing in them, it would be very reassuring to know it. If there is, then nothing but the iron hand will bring Germany to a realisation that it no longer pays to indulge in the bad faith that has made her name a by-word among the nations.



Two views of a Sikorsky biplane, fitted with four 160 h.p. German Argus motors, after a bad landing



## ANTI-AIRCRAFT SERVICES

It was announced by the War Office on May 14 that the names of the following have been brought to the notice of the Secretary of State for War for valuable services rendered in connection with the anti-aircraft defences of the United Kingdom, and, where applicable, an entry will be made in the records of service of officers and other ranks (to be dated August 28, 1919):—

BAND, Lieut. J., D.C.M., R.G.A. (S.R.); BARRETT, Lieut. J., R.G.A. (S.R.); BOURNE, Lieut. J., R.F.A. (S.R.); BURGESS, Lieut. C. E., R.F.A.; CLARK, Lieut. G. C., R.F.A. (S.R.); CROMBIE, Lieut. W. S., R.F.A. (T.F.); FISHER, Lieut. (A./Capt.) C. L., R.F.A.; HARRAWAY, T./Capt. V. J., R.G.A.; SANDEMAN, Maj. T. F., M.C., R.F.A.; STILL, Lieut. H. N., R.G.A. (S.R.).

AVESON, 57356 Gnr. (A./L./ Bombdr.) H. W. R., R.G.A.; BANNISTER, 143980 Gnr. (A./Bombdr.) A., R.G.A.; BICKERTON, 131731 Gnr. (A./Cpl.) H., R.G.A.; BURDETT, 157713 Gnr. (A./Sgt.) F. B., R.G.A.; BURN, 131443 Gnr. (A./Cpl.) F. C., R.G.A.; BUTLER, 131446 Gnr. (A./Cpl.) R. W., R.G.A.; CALVERT, 284028, By. S.M., S. B., R.G.A.; CONSTABLE, 22172 Sgt. J., R.G.A.; CUDDEFORD, 52408 Cpl. (A./Sgt.) H., R.G.A.; DAGUTSKI, 131385 Gnr. (A./Sgt.) A., R.G.A.; DOBBIN, 876 Cpl. (T./Sgt.) J., R.G.A.; DUVAL, 37416 Bombdr. (A./Sgt.) W., R.G.A.; GASCOIGNE, 84328 Gnr. (A./Sgt.) T. M., R.G.A.; GILBERT, 192606 Sgt. (A./By. Q.M.S.) W. W.,

D.C.M., R.G.A.; GOUGH, 92831 Gnr. (A./Sgt.) T. W., R.G.A.; GRANGER, 79393 Gnr. (A./L./Bombdr.) E., R.G.A.; HARDACRE, 174874 Bombdr. (A./Cpl.) W., R.G.A.; HARDING, 29904 Gnr. (A./Sgt.) G. H., R.G.A.; HARVEY, 18560 By.S.M. (T./R.S.M.) R., R.G.A.; HENDERSON, 201641 By. S.M. F. A., R.G.A.; HICKS, 191648 Sgt. (T./By. S.M.) C., R.G.A.; HODGETTS, 84683 Gnr. (A./Sgt.) S., R.G.A.; HOSKEN, 132152 Gnr. (A./Cpl.) W. H., R.G.A.; HUDSON, 192573 C.S.M. C. J., R.G.A.; HURST, 103165 Cpl. M., R.G.A.; LEEDHAM, 6512 By. S.M. W. R., R.G.A.; LUKE, 21121 Gnr. (A./Cpl.) E. E., R.G.A.; MCKEAND, 144431 Gnr. (A./Bombdr.) A. W., R.G.A.; MERRY, 30677 Sgt. W. E., R.G.A.; MIST, 158378 Sgt. F., R.G.A.; MORGAN, 192582 Sgt. (A./By. Q.M.S.) H. W., R.G.A.; MULHALL, M2/046168 Sgt. H. S., R.A.S.C. (M.T.); NIELD, 131274 Gnr. (A./Cpl.) E., R.G.A.; O'REILLY, 201325 Gnr. P., R.G.A.; PALMER, 192607 Cpl. E. R., R.G.A.; PEARSON, 132594 Cpl. (T./By. S.M.) W., R.G.A.; ROLLASON, 321946 Bombdr. (A./Sgt.) P., R.G.A.; SMITH, 129866 Gnr. (A./L./Bombdr.) J. H., R.G.A.; THOMAS, 101053 Sgt. Arty. Clk. (T./S.M. Arty. Clerk) W. H., R.G.A.; TRIMMER, 352343 Cpl. L. W., R.G.A.; TRINER, 184527 Gnr. G., R.G.A.; VON EHREN, 192694 R.Q.M.S. H., R.G.A.; WARNE, T/366 Armt. S./Sgt. C. W., R.A.O.C.; WILLIAMS, 321009 Sgt. (T./By. S.M.) W. T., R.G.A.; WOODFORD, 93673 Gnr. (A./Sgt.) R. E., R.G.A.; WOOLFORD, 128469 Cpl. (A./Sgt.) F., R.G.A.

## AIR MINISTRY ANNOUNCEMENTS

### Lille Aerial Lighthouse

The aerial lighthouse at Lille Aerodrome has been removed and is not now in operation. Notices to Airmen No. 24 of March 9 and No. 42 of April 22, 1920, are therefore cancelled. (A.M. Notices to Airmen No. 55.)

### Scholarships at R.A.F. Cadet College

THE Air Ministry makes the following announcement:— A gift of £1,500 has been generously placed at the disposal of the Air Council by the Orange Free State Branch of the Victoria League for the permanent use of the Royal Air Force.

It has been decided to apply this sum to the endowment of a number of scholarships tenable at the Royal Air Force Cadet College by South African flight cadets to be known as the "Victoria League" Scholarships.

All candidates for admission to the College whose fathers are British subjects and normally resident in the Union of South Africa will be eligible to compete for these scholarships.

Two scholarships will be offered for competition each year, one at the examination for admission to the Royal Air Force Cadet College held in June, and one at that held in November. They will be tenable for one year, and of the annual value of approximately £35, payable half-yearly in arrear in equal instalments. They will on each occasion be awarded to the candidate fulfilling the conditions prescribed above who successfully passes the competitive

entrance examination with the highest number of marks and is selected for admission to the college.

A "Victoria League" Scholarship may be held in addition to a King's or Prize Cadetship.

The names of intending candidates for these scholarships should be communicated to the secretary (D.T.O.), Air Ministry, Kingsway, London, W.C.2, by whom they should be received not later than May 15 and October 15 for the examination to be held in June and November respectively. They should be accompanied by a certificate of eligibility.

Applications to compete for a scholarship should be sent forward independently of the ordinary application for admission to the examination for the purpose of entry to the Royal Air Force Cadet College; these latter applications should continue to be addressed to the Secretary, Civil Service Commission, Burlington Gardens, London, W.1, and should be forwarded in the manner prescribed, and not later than the dates given in the announcement issued by the Civil Service Commissioners in advance of each examination.

In view of the imminence of the forthcoming examination for admission to the Royal Air Force Cadet College in June, it has been decided that, although the scholarship will be awarded on the results of that examination, application to be considered for the award of a "Victoria League" Scholarship will be entertained on this occasion only provided that they reach the Air Ministry not later than August 15, 1920.

### Mentioned in Dispatches

It was announced in a supplement to the *London Gazette* of May 21 that the names of the following officers are to be added to those brought to the notice of the Secretary of State for War for valuable and distinguished services rendered in connection with military operations at Archangel. (Published in the Supplement of the *London Gazette* dated February 3, 1920): Lieut.-Col. R. J. Bone, D.S.O., R.A.F.; Maj. and Bt.-Lieut.-Col. R. Grey, D.S.O., G. Gds. and R.A.F.; Lieut.-Col. L. Tomkinson, D.S.O., R.A.F.

### The R.A.F. at Royal Review

A UNIQUE feature of the Royal Review at Aldershot on May 21 was the appearance of a detachment of the R.A.F. in their blue uniforms, in the march past. The men who carried rifles, with fixed bayonets, created a very favourable impression.

### A Collision at Cologne

THE Air Ministry regrets to announce that Flight-Lieut. C. B. Ridley and Flying Officer J. D. de Pencier were killed on May 17 while flying near Cologne. Both officers were attached to No. 12 Squadron, R.A.F., and at the time of the accident were flying separate machines.

According to the *Lokalanzeiger* the two British aeroplanes collided in the air at Lindenthal and both crashed from a

height of 450 ft., with the result that two officers were killed, and one officer and one mechanic were slightly injured.

From a message from Berlin on Sunday, it would appear that a similar accident occurred at the same place on May 22.

### Good Work by the R. 33

SOME interesting tests were carried out during a cruise of the R. 33 from her station at Howden, Yorks, to the South Coast last week. Howden was left at 8 p.m. on May 20, in charge of Capt. G. M. Thomas, D.F.C., and having on board Commander Maxfield and six members of the American crew in training to take over the R. 38. Soon after starting and when at a height of 1,500 ft. an old Sopwith "Camel" was slipped in order to test a special fuel tank. The machine, with the engine running, nose-dived to the ground and smashed the tank, which was largely made of rubber, but there was no fire.

The airship then went on and reaching Croydon about midnight carried out observations to ascertain the visibility of the Croydon lighthouse; the light was clearly seen at a range of 27 miles. The airship went on to Lympne, but the light was not burning there. Returning to Croydon, tests were carried out with coloured lights and the airship cruised back to Howden, which was safely reached just before 8 a.m. on May 21.



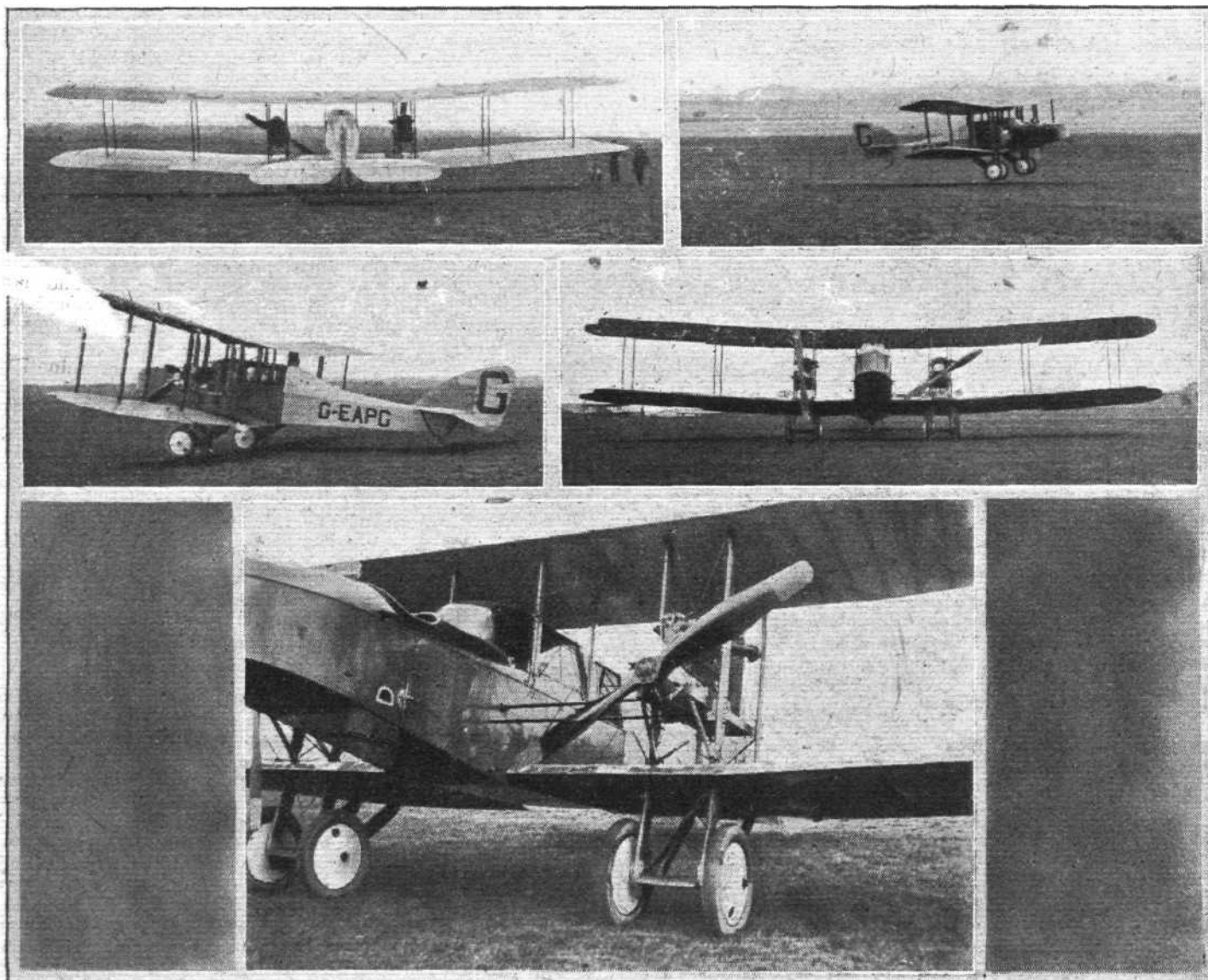
# A NEW CENTRAL AIRCRAFT PASSENGER MACHINE

SCALE built by crash of cro machi proved the powe. ing was high, the machine being fitted with two Beardm engines of 160 h.p. A second machine has been finished some time now, and has again proved the qualities of Mr. Fletcher's design. The second machine, of which we publish several photographs below, is identical with the previous type, excepting the cabin arrangement. In the first machine the passengers' accommodation was left open, as it was thought that the best policy would be to see how the machine behaved before fitting her out with an elaborate cabin. In the present machine, however, a cabin superstructure has been added, inside which the passengers are comfortably seated in three pairs. In front of the cabin is the pilot's cockpit, which also accommodates an "outside" passenger. This brings the total live load up to eight people, including the pilot. While this is a not inconsiderable load for 320 h.p., it does not represent all that the machine is capable of. Recently a demonstration was given of flying with eight up plus a sand load of about 400 lbs., so that the weight carried was equivalent to at least ten passengers.

Even with that load the machine got off very quickly, piloted by Lieut. F. T. Courtney, and climbed very well. The day was windy, with many gusts, but the machine appeared to be very steady. After climbing to about a thousand feet or so, Mr. Courtney gave a demonstration of flying on one engine only, the other being throttled right own. So far as one could see there was little tendency for

the machine to get into a spin, the large rudder and fin preventing this. It was, however, found that there was not quite sufficient movement of the rudder to overcome the yawing moment without slightly diving the machine so as to maintain the speed. This can be easily overcome by a slight alteration to the tail, and there is then little doubt that the machine will be able to stay up with only one engine running. That she lost height during the demonstration flight—and not a great deal of it at that—was not directly due to the halving of the power, but to the necessity of diving to make the rudder sufficiently effective. When alterations have been made which will allow the rudder to be moved to a slightly greater angle, the yawing moment should be easily overcome without diving.

With the load carried last week the machine has a speed of close on 80 m.p.h., which is distinctly good for such a high power loading, and in a third machine, which is now coming along, several refinements will be incorporated, which, it is anticipated, will bring the top speed up to about 90 m.p.h., with an economical cruising speed of about 75 m.p.h. The machine will then be a very economical one for commercial work, as the engines are very economical in fuel and oil consumption, and the speed is such as to be sufficient for most purposes. Add to this the fact that the machine gets off very quickly and pulls up after a very short run, and it will be seen that Mr. Fletcher and the Central Aircraft Co. have produced a machine which is full of promise as a real commercial proposition, the running expenses being exceptionally low, while the constructional design is on such simple lines as to be cheaply produced and cheaply repaired. We have little doubt that the machine will be extensively used not only in this country but also abroad and in the Colonies, for which latter it would appear to be especially suitable.



**TEN PASSENGERS ON 320 HORSE-POWER:** A Central Aircraft Co. cabin machine at Northolt. Our photographs show the machine in front, rear, and three-quarter rear views. The lower picture shows the cabin and one of the 160 h.p. Beardmore engines. In the top right-hand corner the machine is seen taking off with eight people and 400 lbs. of sand on board, piloted by Lieut. F. T. Courtney





## CAIRO-CAPE PILOTS HONoured

ON Tuesday of last week a banquet was given by the Anglo-African community at the Savoy Hotel in honour of Col. Sir H. A. van Ryneveld, D.S.O., M.C., and Flight-Lieut. Sir C. J. Q. Brand, D.S.O., D.F.C., M.C., the two South African-born pilots, who recently accomplished the feat of flying from Brooklands to Wynberg (Cape Town), starting on February 4 and completing the journey on March 20. The actual flying time was 109 hours, and three machines were used, named "Silver Queen I," "Silver Queen II" and "Voortrekker," the latter one taking up the running after the first two had crashed. The Secretary of State for War and for the Air, Mr. Winston Churchill, occupied the chair in honour of the guests, and amongst those present were Lord Morris, Sir Edgar Bowring (High Commissioner of Newfoundland), Sir Lionel Phillips, Mr. R. A. Blankenberg (Acting High Commissioner for South Africa) and Mrs. Blankenberg, Col. L. S. Amery (Under-Secretary of State for the Colonies) and Mrs. Amery, Sir Owen Philipps, M.P., Sir Roderick Jones, Capt. P. D. Ackland (general manager of Aviation Department, Vickers, Ltd.), Dr. Chalmers Mitchell (who accompanied *The Times* flight expedition on the same airway), Maj. Ewart Grogan (who walked from Cape Town to Cairo 20 years ago), Capt. S. Cockerell, and Capt. F. C. Broome.

Mr. Churchill, in proposing "Our Distinguished Guests," said they were met to welcome with most sincere feelings of admiration and enthusiasm the heroes of one of the three or four great and memorable exploits of aviation. Both their guests had played a fine part in the War. They fought in the most dangerous branches of the aviation service. Sir H. van Ryneveld commanded an aviation wing, having worked his way up from rank to rank, and Sir C. Brand had the distinction of clawing down a German bombing-machine by night-flying over London. Anyone who had flown to any considerable extent knew how numerous were the dangers which at every step lay in wait for the aviator. When they considered the enormous waste of country upon which no landing would be practicable if any failure occurred to the engine, the vast expanse of desert before the Soudan was reached, the enormous areas of the most dreary spaces on the face of the earth—when they contemplated the dangers they would know how to appreciate the extraordinary risks and hazards which these two officers encountered and successfully overcame. Their achievements brought out great qualities of stubbornness and determination. In the end they achieved what they had set out to do. They arrived at Cape Town, and they had a right to claim to be the pioneers of that great future aerial route. This flight had drawn South Africa much closer to the Mother Country. It might be that a good many years would pass before the Cairo-to-the-Cape route—which was so dear to the imagination of that great man, Cecil Rhodes—became a safe, sure, regular highway for aircraft, but that it would so become they could have no possible doubt, and the more it was used and the longer it was used the greater would be the debt of gratitude to the men who showed the way. But quite apart from that, the fact that we felt that in this flight we had a new tie and a new bond associating the British Isles with the Union of South Africa was to him very important and very great. That that flight should have been accomplished by an aviator who belonged to the Dutch race in South Africa, and who had fought with so much courage in the great War, accepting in the fullest sense of the word the great citizenship of the British Empire, and one of those men who, like Botha and Smuts, not only the whole British Empire but the whole civilised world was under the deepest obligation to. That a Dutchman should have taken part in this knitting together process which had been forwarded by aviation was to his mind specially satisfactory.

The years which lay before the British Empire were no doubt full of anxiety and difficulty, but he spoke with feelings of assured confidence when he told them that he believed we were entering upon the most brilliant period that we had ever seen in our long and varied history. We had not yet fully realised the greatness of the victory that had been gained, or the immensity of the consequences which would flow from the practical union of the whole British Empire in the field against a common enemy and in the cause of justice. Those consequences would roll forward, and he saw no reason why we should not count on more than one generation in which the British name and the British Empire would be regarded as the leading moral and physical factor in the general progress and well-being of mankind. In this great triumph of the British race and the British Dominions, the

achievement of their two guests in accomplishing this most dangerous exploit and joining together by a new method the Union of South Africa and the British Isles, had played a noteworthy and a distinguished part.

Col. Sir H. A. van Ryneveld, in responding, once again expressed their great obligation and appreciation of the assistance rendered by the South African Government and the R.A.F. during the flight. He expressed great gratification in seeing Dr. Chalmers Mitchell and Capt. Cockerell and Capt. Broome present, as they really possessed a record in having covered the greatest distance on the way to Cape Town with a single machine. They had not had the advantage of being able to obtain relays of machines, without which it would have been impossible for themselves to have got through.

Flight-Lieut. Sir C. Brand also briefly replied.

Col. L. S. Amery, M.P., in proposing "South Africa," was eloquent with a paean of praise for that fascinating country, and spoke of the magnetic attraction which South Africa seemed to have for all who had once been there. He was very happy in some of his reminiscences of his past experiences in that country, especially in association with the present Secretary of State for Air, during their work through the Boer War, whereby Mr. Churchill, by reason of that extraordinary energy and alertness which he possessed, prompting him to be first in whatever movement he might be concerned, was landed into being captured by Gen. Botha and held a prisoner.

Sir Lionel Phillips responded.

Sir Owen Philipps proposed "Trans-African Flight," and said he was one of the great believers in the future of postal and other services by the air across the great African continent. He thought we all owed a great debt of gratitude to Dr. Chalmers Mitchell for what he had attempted, and also to Lord Northcliffe for what he did years before the War to help on the practical work in aviation. It was these flights, whether successful or otherwise, which were doing great work in helping on to the time when everyone would be able to travel long distances by air, with absolute safety and greater speed than by mail steamer or express train.

Dr. Mitchell, in responding, said there was no one in that room who congratulated their guests more heartily than he did, because from personal experience he knew the difficulties which they had overcome in their great adventure. When by a combination of three of the greatest forces in the world—the energy and vision of the Air Ministry, the enterprise of the Press, and, in particular, of his very great friend, Lord Northcliffe, and the enterprise and capacity of the great manufacturing firms, the makers of engines and aeroplanes—the great flight in which he took part was started, he was optimistic in spirit but very doubtful as to the possibility of getting through. He had come back a convinced believer in the future of flying and in the practical future of flying across Africa. He believed the future of flying across Africa to be much nearer than the chairman had suggested in his speech. He believed so because of certain practical urgencies which were impressed upon him while he was in Africa. The problems of our fellow-citizens in different parts of the Empire could be dealt with more expeditiously and satisfactorily by the development of the aeroplane as a swift and comfortable means of travel for our colonial and home statesmen. In the prosecution of the federation of the Empire annual or more frequent meetings of the Prime Ministers of the Dominions and the Colonies with our own Prime Minister would be possible. Another problem that might be solved by the aeroplane related to the officials in tropical colonies. For reasons of health they required to have three or four months' leave at least every two years. At present leave was reckoned as so many months *plus* the time it took to get from the colony to London and back, and it meant that something like three months every two years was wasted. If that were put into practical figures it meant that something like 12 per cent. of the salaries of important colonial officials was thrown away at the present time. Then there was a commercial future before the aeroplane. In many of the places where he landed, bankers and representatives of Chambers of Commerce came to see him and impressed upon him the urgency of more rapid postal communication. The aeroplane had also a useful future in the sphere of scientific exploration and investigation, as was shown by the discovery of great volcanic areas north of Khartoum. With regard to the aeroplane itself, there was a very important need for further engine development.



In regard to the route, this had been mapped out from the ground, without aeroplanes. The best had been done under the circumstances, but this left a great deal to do. In practice it was found that there were numerous places where it was good for landing and taking off again, which had not been noted or in any way suggested. What was required therefore was to re-survey the route from the air, and then it would be found that it would be very much easier and cheaper for the next pilots who undertook the

South African flight. Engines with absolute reliability, he thought, was the crux of the whole problem, and he hoped Mr. Winston Churchill would use his utmost influence and insist upon the necessary money being forthcoming for experimenting and for perfecting the aviation engine, and thus make sure of the Empire's supremacy in the air.

The final toast of the "Chairman" was in the hands of Mr. R. A. Blankenberg, Acting High Commissioner for the Union of South Africa.

## THE ROYAL TOURNAMENT

BEFORE the War this wonderful entertainment—then known as the Royal Military Tournament, and last year as the Royal Military, Naval and Air Force Tournament—was one of the outstanding features of the London Season. This year as the Royal Tournament it promises to surpass anything yet seen. With the memories of War still so vividly to the fore with almost every man, woman and child, the appeal of this remarkable show should draw to Olympia the major portion of London's residents during the period it is open to the public. A start was made on May 20, when the inaugural performance was attended by the Duke of Connaught, and two shows take place daily until June 5 next. The programme itself is so intensely interesting that on its merits the "full house" boards should be out every day by the time of opening. It is incidental that the net proceeds go to the Naval and Military Charities, which are so dear to the hearts of our country.

Although, from the nature of its element, Aviation is not so prominent in a practical form as one might personally wish, nevertheless there are items in the daily programmes in association with this branch of the Empire's military activities which will be welcomed.

It need not be feared that the rest of the displays of skill and practical work will not interest the visitors. Every item at each performance is a "star turn" in itself; whether it be the vaulting by the R.F.A., machine gun display by one of the Machine Gun Corps, displays by the Royal Engineers, R.A.S.C., or a Royal Naval and Royal Marine Inter-Port Field Gun Display, all are equally fascinating, and hold one's attention at concert pitch. Anything more striking than the display of physical training, boxing and bayonet training by the Royal Marine Light Infantry can hardly be sought for. If possible, the Musical Double Ride of the

Royal Horse Guards is more delightful than ever. This unique performance has never been seen to greater advantage, and the re-appearance of this fine body of men and mounts in all their pre-War "Armour" is distinctly pleasing. As if this were not an all-sufficient surfeit of good things, there follow the two great attractions of this year's entertainment: the Grand Pageant, "I remember," illustrating the British Forces in the 18th, 19th and 20th centuries, and Old Time Platoon Firing Exercises by First Guards (now Grenadier Guards), 1793, by the King's Company 1st Bn. Grenadier Guards.

A popular feature introduced in the Grand Pageant is the appearance of Ol' Bill and Naval and Chelsea Pensioners, whose dreams result in the picturesque happenings which follow. The success of this portion of the programme is to the credit of Lieut.-Colonel A. Peel, C.M.G., Royal Marine Light Infantry, and perhaps no small praise is due to the really admirable way in which the "dressing" of the performers has been carried out by Mr. Willie Clarkson.

Like in all other directions, the management is severely handicapped by the increase in cost of everything, including transport, railway travelling, rent and every other item without exception. Therefore is it the more essential that the public should roll up in their tens of thousands to do duty (in the form of entrance money) to the charities to which the proceeds go, the charities which represent benefits to be conferred upon those who were dependent upon the brave men who passed out during the ghastly events of 1914-1918. In this connection even the vast seating capacity of Olympia should be far too small to accommodate those who would wish to see the Royal Tournament of 1920. Therefore one final word lest there be any who might forget, "I remember."

### The Handley Page New Wing

THE Marquess of Londonderry, Under-Secretary of State for Air; Major-Gen. Sir Frederick H. Sykes, Controller-General of Civil Aviation; Gen. E. D. Swinton and Monsieur Flandin, the French Air Minister, witnessed the other day at the Cricklewood Aerodrome a flight by an aeroplane fitted with the new Handley Page wing.

### No Air Mail on Whit Monday

It was announced by the Postmaster-General that no air mails would be dispatched to Paris on Whit-Monday.

### Air Mails to Belgium

FOLLOWING the recent invitation issued by the Postmaster-General to British firms to tender for carrying mails by air to Holland, tenders are being invited for a similar service to Belgium. The tenders for this service have to be sent in by June 21.

### Aerial Police for Canada?

It has been suggested by a member of the Canadian Air Board that air service stations should be established in North Saskatchewan, and aircraft used to patrol the northern areas for police purposes, and to photograph unsurveyed parts to find land suitable for farming.

### An Aerodrome at Rangoon

AN official notice published in the *Burma Gazette Extraordinary*, dated April 14, sets forth details with regard to a piece of land in the Rangoon Town District, Tamwe circle, which the local Government declares is required for a public purpose, namely, for a site for an aerodrome. The total approximate area of the ground is 178.584 acres.

### Air Service to Scandinavia

FROM information appearing in the *Social Demokraten*, it appears that as a result of negotiations between Col. Noel, of Messrs. Handley Page, Ltd., and Danish air companies, there is every likelihood of a regular air route between England and the Scandinavian countries being established in the

course of the summer. The route to Denmark will probably be via Esbjerg and Holland.

### Flying Regulations in Spain

It was announced in *FLIGHT* some time ago that aviators proposing to arrive in Spain by air had to obtain permission from the Spanish diplomatic representative in the country from which it was proposed to start. It is necessary to set forth the proposed place of landing in Spain, the object and duration of the visit, the name of the pilot, and the nature of the cargo. Aviators must be provided with a health certificate. Forced landings at aerodromes on the frontier will be dealt with by the Health and Customs Services.

### Austrian Aircraft Production

ACCORDING to *The Times* correspondent in Vienna, Col. Barras, chief of the French section of the Allied Mission, has sent to Dr. Deutsch, Austrian Minister of War, a Note in which he states that, subject to the concurrence of the Ambassadors' Council, he will allow the factories and establishments which produced aircraft material during the war to continue to work up the existing stocks of raw material. Special attention is directed to Articles 147 and 148 of the St. Germain Treaty, and raw material is defined as excluding parts already so far worked up that they are suitable for aircraft gear or motors, or the equipment thereof.

### The U.S. Air Mail Successful

AT the formal opening of the Pan-American Aeronautical Congress at Atlantic City on May 20, a statement made by Mr. Burleson, the U.S. Postmaster-General, was read. It was claimed that the service had proved itself economical both as regards cost and time. In the first year of its working 193,000 lb. of letters were carried, while in the year which ended on May 20, 538,734 lb. were carried. The Congress was opened with a wireless message from President Wilson.

Following an address by Brig.-Gen. Evans of the U.S. Army, the Congress on May 21 passed a resolution urging both Federal and State Government aid for aviation.



# NOTES ON FLYING BOAT HULLS

By Major LINTON HOPE, M.I.N.A., F.R.Ae.S., Consulting Naval Architect to H.M. the King of the Belgians and to the Air Ministry.

(Continued from page 548.)

It has been suggested that P.5 and later boats of much larger size, designed by the writer, have been evolved to some extent from C.E.1, but a glance at the profiles of the 41-ft. design of 1916 (Fig. 7) and the 45-ft. P.5 of 1918 (Fig. 8) will show at once that the latter boat is obviously developed from the

weighed 436 lbs., 437 lbs. and 440 lbs., the estimated weight being 430 lbs. The variation of the fore and aft position of the hull C.G. was  $\frac{1}{8}$  in. aft and  $\frac{3}{8}$  in. forward, while the C.G.s of the 45-ft. P.5 and the 64-ft. boat were both exactly as designed.

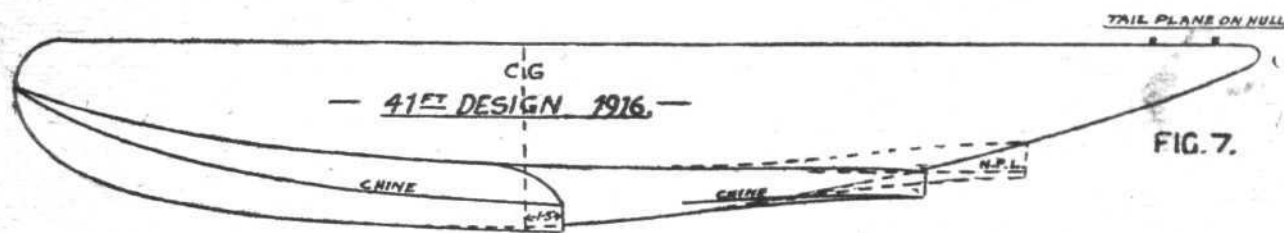


FIG. 7.

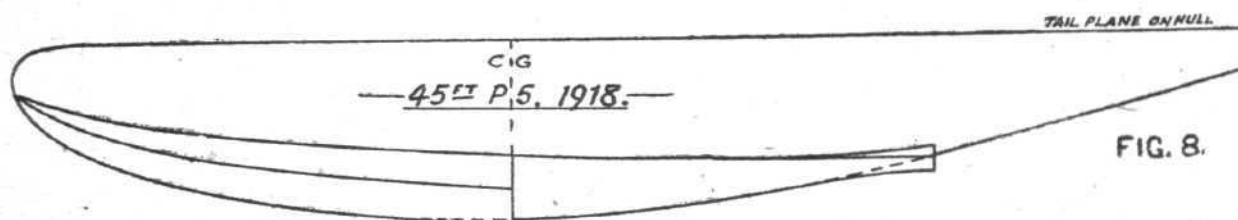
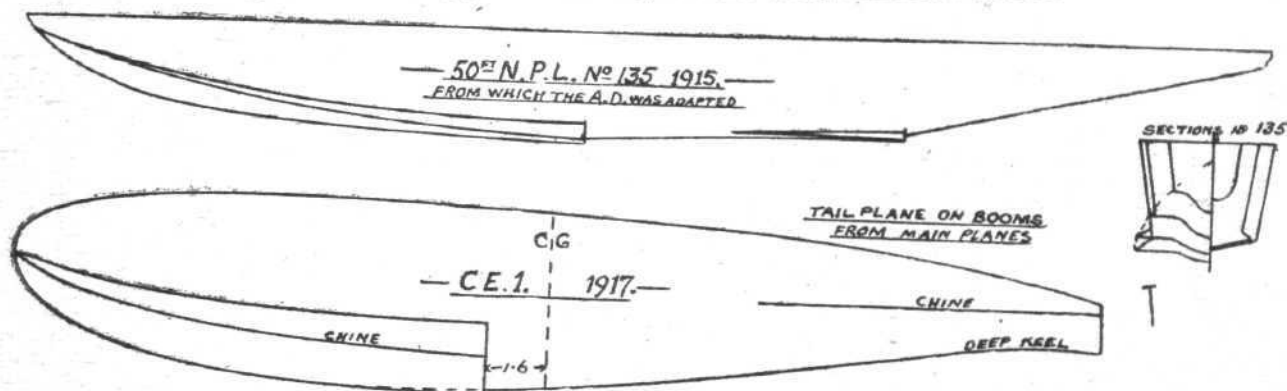


FIG. 8.

Figs. 7 and 8.—Major Linton Hope's 1916 design and P. 5 of 1918



NOTES ON FLYING BOAT HULLS : The 50-ft. N.P.L. No. 135 of 1915 and the C.E. 1 of 1917

writer's original 1916 type, which was totally different from any flying boat in existence at that time.

C.E.1, built in 1917, in her general form, is not in the least like either the 1916 41-footer or the 1918 P.5, except that the main planing bottom, forward of the step of C.E.1 (see Fig. 9), has a marked resemblance to that of the writer's 1916 design, the lines of which were lent to the Royal Aircraft Factory, Farnborough, where the design was made after many tests at the N.P.L. tank.

She was built under the supervision of the writer and to his specification of  $\frac{3}{8}$ -in. single skin mahogany, for the main hull, the construction being generally similar to that of the A.D. boats already mentioned, but owing to the difficulty of construction of the tail the labour per square foot of hull surface was increased 15 per cent.

The last design is for a flying boat of 72,000 lbs. weight and over 80 ft. in length, and the construction section (Fig. 10) is that of an intermediate size design for 32,000 lbs. The first boat built from this design came out only 12 lbs. in excess of the estimated weight for the bare hull, while a second boat, built by another firm, was only 130 lbs. more. Figs. 11 and 12 are photographs of this boat while under construction, made by Capt. Jones, R.A.F.

As the estimated weight was nearly 3,000 lbs., these errors are almost negligible, and the difference between the boats is probably entirely due to difference in the specific gravity of the timber.

Additional examples of the accuracy with which it is possible to estimate weights with this system of construction are two 24-ft. boats (Fig. 14), estimated weight 216 lbs., actual weights 210 lbs. and 209½ lbs.

Three 30-ft. A.D. boats, built by three different firms,

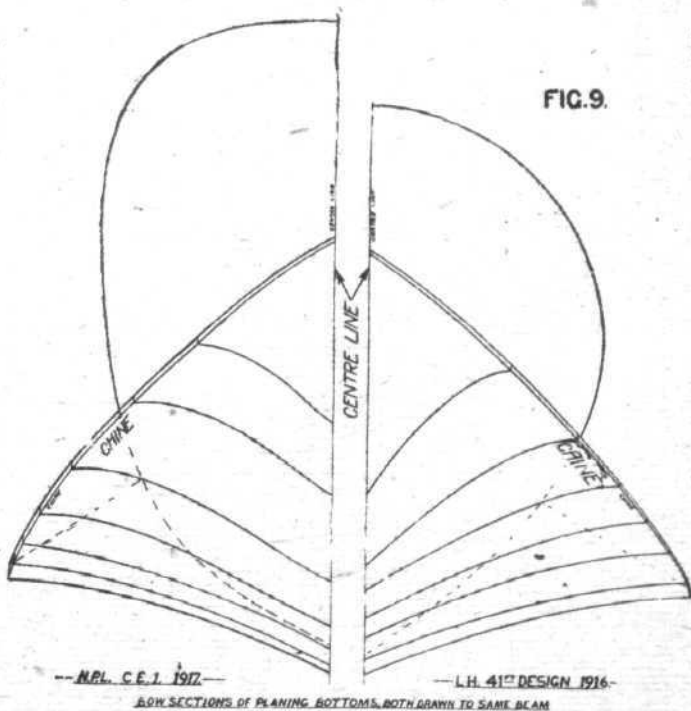


Fig. 9.—Bow sections of planing bottoms of N.P.L. C.E. 1 and L.H. 41-footer

# FLYING BOATS

No	Power.	Dimensions of Hull.			Dimensions of Planing Bottom.		Main Structure.					Planing Extensions.			Weight of Wing Root.	Total Weight.		Total Displacement of Hull in lbs.	Wt. per lb. of Hull Displacement.	Displacement in Flying Trim.	Surplus Buoyancy.	Position of C.G. of Machine.*	Weight H.P.	Remarks.
		L.	B.	D.	L.	B.	Area of Hull.	Thickness of Skin.	Timbers.	Stringers.	Weight in lbs.	Weight per sq. ft.	Area.	Thickness.		Weight per sq. ft.	Estimated.							
1	2 Curtiss, 90 h.p.	32.96	4.08	5.76	12.37	3.00	276.0	$\frac{1}{8}$ in. spruce and fabric ribbon and carvel	$\frac{3}{8}$ in. x $\frac{5}{8}$ in. ash, spaced 6 in.	Ribbands, 1 in. x 1 in. ash	—	—	123	$\frac{3}{8}$ in. mahogany diag., $\frac{1}{8}$ in. mahogany F. & A.	—	—	—	24,256	—	6,000?	p.c. 304.3	ft. .75 F	lbs. —	1 step. No F. & A. keelson or deep stringers. 1 step.
2	Austro-Daimler, 120 h.p.	24.50	4.36	3.05	12.50	4.00	192.3	2 skins, carvel sewn	—	—	—	—	—	—	—	—	—	—	—	—	2.25 F	—	—	
3	—	24.00	4.25	3.08	12.50	4.00	202.4	Top sides, $\frac{1}{8}$ in. diag.; $\frac{1}{8}$ in. F. & A. Bottom, 2 skins cedar, $\frac{3}{8}$ in. diag.; $\frac{1}{8}$ in. F. & A. mahogany	$\frac{3}{8}$ in. x $\frac{1}{8}$ in. elm, spaced 4 ins.	$\frac{3}{8}$ in. x $\frac{5}{8}$ in. spruce	—	—	—	—	—	460	9,150	.0503	2,934	212	2.25 F	24.5	Hull C.G. 2.625 F. Improved type. 1 step.	
4	Mono-Gnome, 100 h.p.	26.16	3.50	3.25	9.00	3.25	197.7	—	—	—	320.0	1.618	—	—	—	—	320	7,800	.0410	2,260	—	.833 A	22.6	1 step.
5	2 320 h.p. Sunbeam, 1 300 h.p. Rolls-Royce	56.00	7.00	11.00	24.00	14.00	1172.0	$\frac{1}{8}$ in. mahogany diag., $\frac{1}{8}$ in. cedar, F. & A.	$\frac{1}{8}$ in. x $\frac{1}{8}$ in. R. elm, spaced 2 in.	$1\frac{1}{8}$ in. x $\frac{3}{4}$ in. to $\frac{3}{8}$ in. spruce	—	—	201.9	3 skins—2 inner diag. skins, $\frac{1}{8}$ in. and 1 outer F. & A., $\frac{1}{8}$ in. mahog.	—	—	3,000	114,200	.0262	21,000	453.8	.66 F	22.3	Total area $\times$ P. coef. = .54. Felixstowe design. 1 step. Ditto. 2 step.
6	2 Rolls-Royce, 300 h.p.	42.25	5.00	10.00	30.00	10.00	—	—	—	—	1,583.0?	—	—	—	—	Estd. 192	1,775	53,800	.0330	11,544	—	2.98 F	—	Ditto. 2 step.
7	2 Sunbeams, 320 h.p.	45.00	5.00	10.00	30.00	10.00	—	—	—	—	1,560.0?	—	—	—	—	Estd. 192	1,760	57,338	.0314	12,800	348.0	3.33 F	19.7	Ditto. 2 step.
8	2 Rolls-Royce, 360 h.p.	45.00	5.00	10.00	30.00	10.00	—	—	—	—	1,608.0?	—	—	—	—	Estd. 192	1,800	—	—	—	—	—	—	Ditto. 2 step
9	Hispano-Suiza, 200 h.p.	30.00	3.66	3.83	13.50	4.00	254.0	Carvel, 1 skin, $\frac{1}{8}$ in. mahogany, fabric	$\frac{1}{8}$ in. x $\frac{1}{8}$ in. elm, spaced 1 in.	$1\frac{1}{8}$ in. x $\frac{1}{2}$ in. spruce, tapering F. & A.	346.5	1.36	59.65	$\frac{1}{8}$ in. cedar diag., $\frac{1}{8}$ in. mahogany F. & A.	1.2	450	436	15,040 Error 7 lbs. or 1.5 p.c.	.0304	3,567	321.6	1.16 F	17.8	2 steps.
10	Ditto	30.00	3.66	3.83	13.50	4.00	254.0	Carvel, $\frac{1}{8}$ in. mahogany, 1 skin	Ditto	Ditto	333.0	1.30	59.65	Ditto	1.2	430	440	15,040 Error 4 lbs. or 1.6 p.c.	.029	—	—	1.16 F	—	2 steps.
11	2 Hispanos, 200 h.p.	34.70	4.16	5.70	12.00	8.00	311.0	$\frac{3}{8}$ in. diag., $\frac{1}{8}$ in. F. & A., mahogany	$\frac{1}{8}$ in. x $\frac{3}{8}$ in. spaced 4 in.	—	—	2.43	121	$\frac{3}{8}$ in. diag. mahogany, $\frac{1}{8}$ in. F. & A., $\frac{1}{8}$ in. F. & A.	2.4	—	—	25,530 Error 153 lbs. or 15 p.c.	.0456	6,650	284.0	—	16.6	1 step. F. & A. keelson and stringers.
12	Ditto	34.70	4.16	5.70	12.00	8.00	311.0	Ditto	Ditto	—	—	2.43	121	Ditto	2.4	1,004	1,021	25,530 Error 177 lbs. or 1.7 p.c.	.0400	6,500	286.2	—	16.3	—
13	200 h.p.	23.99	2.83	3.07	12.33	8.00	186.0	$\frac{3}{8}$ in. diag. cedar, $\frac{1}{8}$ in. F. & A.	$\frac{1}{8}$ in. x $\frac{1}{8}$ in. elm, spaced 2 in.	$\frac{3}{8}$ in. x $\frac{5}{8}$ in. spruce	—	—	48.0	3 skins— $\frac{3}{8}$ in. and $\frac{1}{8}$ in. cedar, and $\frac{1}{8}$ in. mahogany	—	—	275	7,032	.0384	2,600	170.4	—	13.0 (?)	2-seater Scout.
14	Hispano-Suiza, 200 h.p.	23.90	3.00	3.50	9.50	4.00	173.0	$\frac{3}{8}$ in. mahogany stringer carvel	$\frac{3}{8}$ in. x $\frac{1}{8}$ in. elm, spaced 1 in.	$1\frac{1}{8}$ in. x $\frac{1}{2}$ in. x $\frac{1}{8}$ in. spruce	165.0	.957	37.5	$\frac{1}{8}$ in. diag. cedar, $\frac{1}{8}$ in. F. & A. mahogany	1.2	216	210	7,331 Error 4 lbs. or 1.8 p.c.	.0280	2,340	213.3	—	11.7	Total area $\times$ P. coef. = .54. Single seater. 2 steps.
15	Ditto	23.90	3.00	3.50	9.50	4.00	173.0	Ditto	Ditto	Ditto	165.0	.957	37.5	$\frac{1}{8}$ in. diag. cedar, $\frac{1}{8}$ in. F. & A. mahogany	1.2	212	209.5	7,331 Error 2 lbs. or 1.1 p.c.	.0280	—	—	—	—	Total area $\times$ P. coef. = .54. Single seater. 2 steps.
16	200 b.h.p.?	28.00	3.50	4.70	12.25	4.90	288.5	Carvel mahogany, single skin, $\frac{1}{8}$ in.	$\frac{3}{8}$ in. x $\frac{1}{8}$ in. R. elm, spaced 1 in. (?)	Heavy spruce, $1\frac{1}{8}$ in. x $\frac{1}{8}$ in. to $\frac{1}{8}$ in. (?)	—	—	—	$\frac{3}{8}$ in. diag. mahogany?; $\frac{1}{8}$ in. F. & A. mahogany?; $\frac{1}{8}$ in. F. & A. mahogany?	—	—	503	527	—	—	4,912 (trial) 4,600 (estd.)	1.6 A	—	12 lbs. excess due to heavy spruce c.g. of hull $\frac{5}{8}$ in. F. of step.





17	2 Rolls- Royce, 360 h.p.	45.00	5.66	6.0	20.23	7.50	560.0	$\frac{1}{16}$ in. $\times$ $\frac{1}{4}$ in. $\times$ $11\frac{1}{2}$ in. $\times$ $\frac{1}{2}$ in. spruce spaced $\frac{1}{2}$ ins.	Estd. 1,160.08	1.36	241	2 skins mahogany, fabric between $\frac{1}{16}$ in. F. & A., $\frac{3}{16}$ in. diag., $\frac{3}{16}$ in. F. & A., $\frac{3}{16}$ in. diag. (aft)	1.2	Estd. 176	1,200§	1,393	48,230 Error 103 lbs. or 8 p.c.	12,000	301.9	16.7 (?)	Total area P. coef. = .90. F. 3 wing struc- ture.
18	2 Rolls- Royce, 360 h.p.	45.00	5.66	6.0	20.25	7.50	660.0	Ditto	Ditto	1.36	241	Ditto	1.2	Ditto	1,202§	1,381	48,230 Error 79lbs. or 6.5 p.c.	12,000	301.9	16.7 (?)	Redesigned wing struc- ture.
19	1,875 h.p. ..	60.00	10.84	—	27.25	12.60	—	—	—	—	—	—	—	—	—	3,106	—	32,400 (max. load) 24,000 (designed) 32,000	4.75 F	—	—
20	4 600 R.R...	64.00	8.5	9.25	17.2	9.5	1,230	$\frac{9}{16}$ in. at 2.036 lbs. per sq. ft. (2 skins)	$\frac{1}{16}$ in. $\times$ $\frac{1}{2}$ in. $\times$ 2 ins.	2.036	—	—	—	—	2,970	2,982	Error 12lbs. or 0.4 p.c.	—	—	—	—

\* F. or A. indicates fore or aft of main step.  
 † Indicates weight without fabric.  
 § Indicates weight without gun mounting and side ports.

All these boats were weighed and balanced in the writer's presence, the weighing machines being carefully calibrated both before and after use.

It has proved very difficult to obtain accurate weights and C.G.s of other types of flying boats, but considerable variation in weight occurred in the case of the F. type boats built by various firms, nearly all of them being well over the weights given for the original boat of the type built at Felixstowe.

The table of data gives the dimensions, weights, etc., so far as ascertainable, of most of the boats in use from the commencement of the War, with the exception of the "Donnet-Leveque" and the "Sopwith Bat - Boat," which were the pioneers of flying boats in this country. Unfortunately particulars of these two were unobtainable by the writer in time to be included in this paper.

### Estimation of Weights and Proportions

*Flexible Type Construction.*—In ordinary boat-building it is necessary to carefully calculate the weight of each detail of the construction separately, and with the early examples of flexible construction the weights were estimated in this very laborious manner.

As subsequent experience proved the variation to be very small between estimated and actual weights, it was found possible to estimate the weight of the bare hull with sufficient accuracy for preliminary calculations by means of ascertained weights of the whole structure per square foot of surface for any given thickness of skin. The proportion of stringers, ribs, hoops, and other parts of the frame always bear the same relation to the thickness of skin, regardless of size, unless a proportionate increase or decrease of strength is desired for special purposes.

The simplest method of ascertaining these weights is to take length, breadth, depth, and thickness of skin in 32nds of an inch.

The length (L), in the following table of weights of seaplane floats, is the mean of length over all and that of the planing bottom, while diameter (D) is the mean of breadth and depth, and (C) is a constant (=1.08 for seaplane floats), then :—  
Weight = LDSC.

Example.	L.	D.	S.	LDSC.	Actual Wt.
	ft.	ft.	ins.	lbs.	lbs.
No. 1 ..	11·00	1·79	3/32	64	64·75
„ 2 ..	13·18	2·28	3/32	97·6	97·00
„ 3 ..	17·77	2·80	4/32	214·0	208·00
„ 4 ..	18·90	2·88	4/32	235·5	242·00

A similar method to the above can be employed for boats and for other types of construction, provided the same proportionate weight of the various parts of the structure remain the same with regard to the thickness of skin; the constant, C, will have to be ascertained from existing floats or boats of each type. For stepless floats it is only necessary to take the length over-all as L. In estimating the weight of flying boats, the area of the thicker planing bottom should be treated as a separate item, as in the table of data, unless all the boats have exactly the same proportion of this planing bottom to

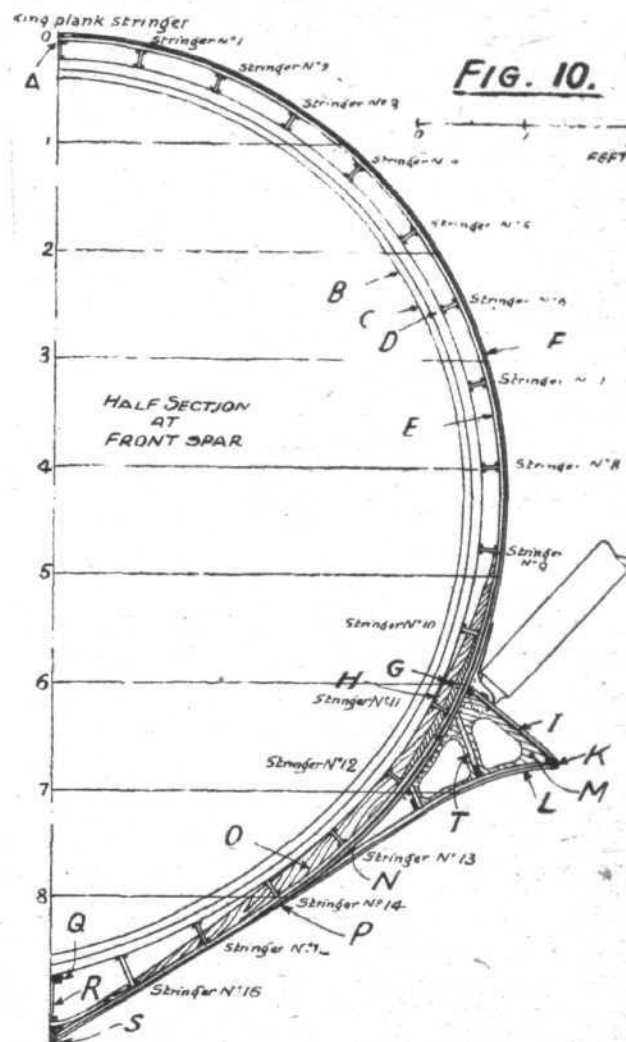


Fig. 10.—Some constructional details of N. 4.—Timbers : Am. elm,  $\frac{5}{8}$  in.  $\times$   $\frac{3}{8}$  in. sided, spaced 2 ins. (main hull, planing bottom, and fin top). Stringers :  $\frac{5}{8}$  in.  $\times$   $2\frac{1}{4}$  in. spruce (except Nos. 14, 15, 16). All fillets  $\frac{5}{16}$  in.  $\times$   $\frac{5}{16}$  in. at hoops,  $\frac{3}{8}$  in.  $\times$   $\frac{3}{8}$  in. at skin (spruce). A, King plank 2 ins.  $\times$   $\frac{5}{8}$  in. spruce, joggled over timbers. B, 2 double hoops, spaced width of spars apart. C, Inner hoop  $1\frac{1}{4}$  in.  $\times$   $\frac{7}{8}$  in. D, Outer hoop  $1\frac{1}{4}$  in.  $\times$  1 in. E, Am. elm strap  $\frac{1}{8}$  in. thick  $\times$  14 ins. wide. F, Planking F. and A.  $\frac{3}{8}$  in. mahogany, diag.  $\frac{3}{8}$  in. mahogany. G, Fin top false stringer  $1\frac{1}{2}$  in.  $\times$   $\frac{1}{2}$  in. spruce. H, Doubling Eng. elm  $\frac{3}{4}$  in. thick at No. 11, tapering to  $\frac{3}{8}$  in. at Nos. 10 and 12 stringers. Length 30 ins. Taper to 6 ins. wide (C.L. of No. 11 stringer)  $\times$   $\frac{3}{8}$  in. thick at F. and A. ends. I, Fin top planking F. and A.  $\frac{3}{8}$  in. mahogany. Diag.  $\frac{3}{8}$  in. mahogany. K, Chine  $1\frac{1}{2}$  in.  $\times$   $1\frac{1}{2}$  in. L, Planking F. and A.  $\frac{3}{8}$  in. mahogany diag.  $\frac{3}{8}$  in. ditto (carried down to main planking). M,  $\frac{1}{2}$  in. 3-ply. N, Solid spruce filling, joggled over timbers. O, Spruce filling, from stringers Nos. 9 to 13. Total width  $6\frac{1}{2}$  ins. From stringer No. 13 to keel, filling  $1\frac{1}{4}$  ins. wide under hoops. P, Diagonal planking on planing bottom finishes here. Q, Top rail  $2\frac{1}{2}$  ins.  $\times$   $\frac{1}{2}$  in. spruce. R, Keelsson  $\frac{3}{8}$  in. spruce. S, Keel 3 in. sided  $\times$   $1\frac{3}{4}$  in. R. elm

main hull, when a common figure may be taken for the whole structure based on the area of the main hull only, as already explained. It is a pity that more details of weight, etc., were not available for the other types of boats in use, but in the rush of war production it was difficult to ascertain exact details of other designers' boats; at the same time, whenever possible, weights have been obtained and are given in the table.

*Estimating Size and Proportions of Hull for a Given Maximum Flying Weight (W).*—It is usual for the designer to receive instructions to design a suitable hull for a machine of some stated weight, and from this it is a comparatively simple matter to ascertain the main proportions of the hull and from

these it should be possible to estimate the weight within 5 per cent., at any rate, for the flexible construction, provided the form is not altered. All the general dimensions of the hull should vary as  $\sqrt[3]{W}$  with the exception of the width of the planing bottom, the proportion of which should slightly increase as the boat gets larger. The reason of this variation in the beam is that the area of the planing bottom is only increasing as the square of the dimension while the weight is increasing as the cube, consequently the lift of the planing bottom does not increase proportionately to the weight, unless the speed is increased also.

(To be Concluded.)

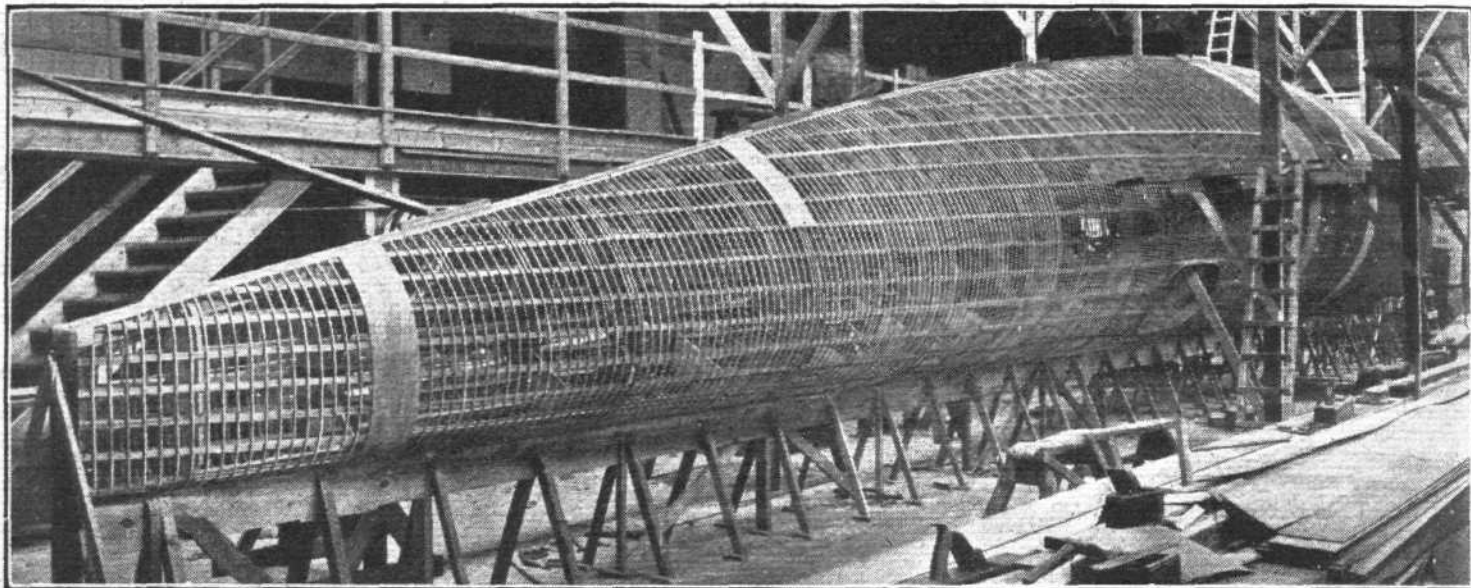


Fig. 11.—The hull of N. 4 in skeleton form

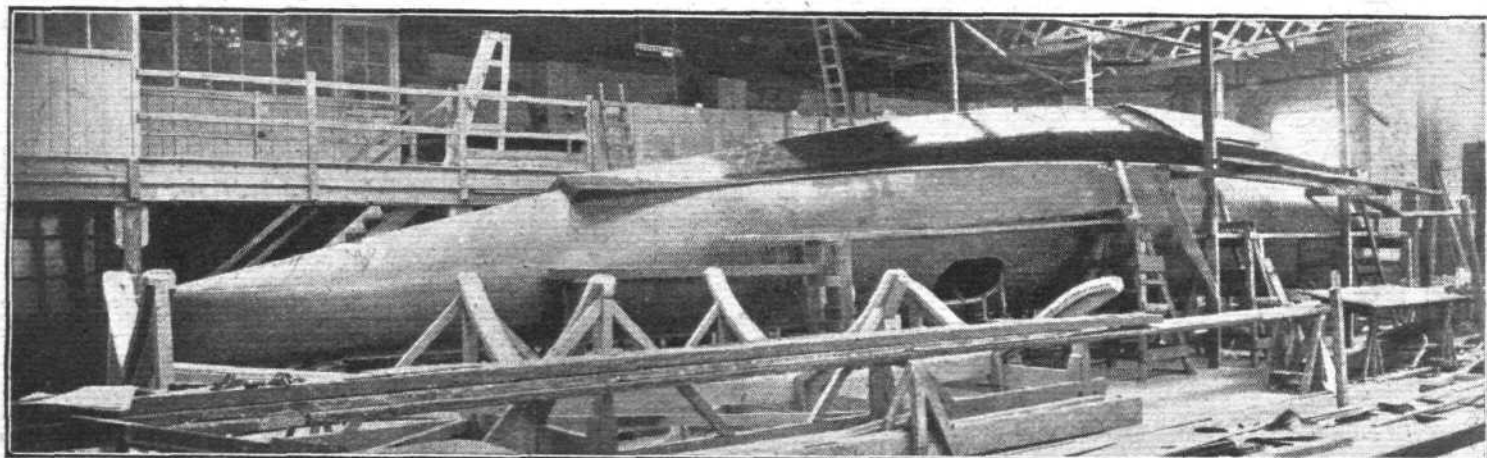


Fig. 12.—The hull of N. 4 completed

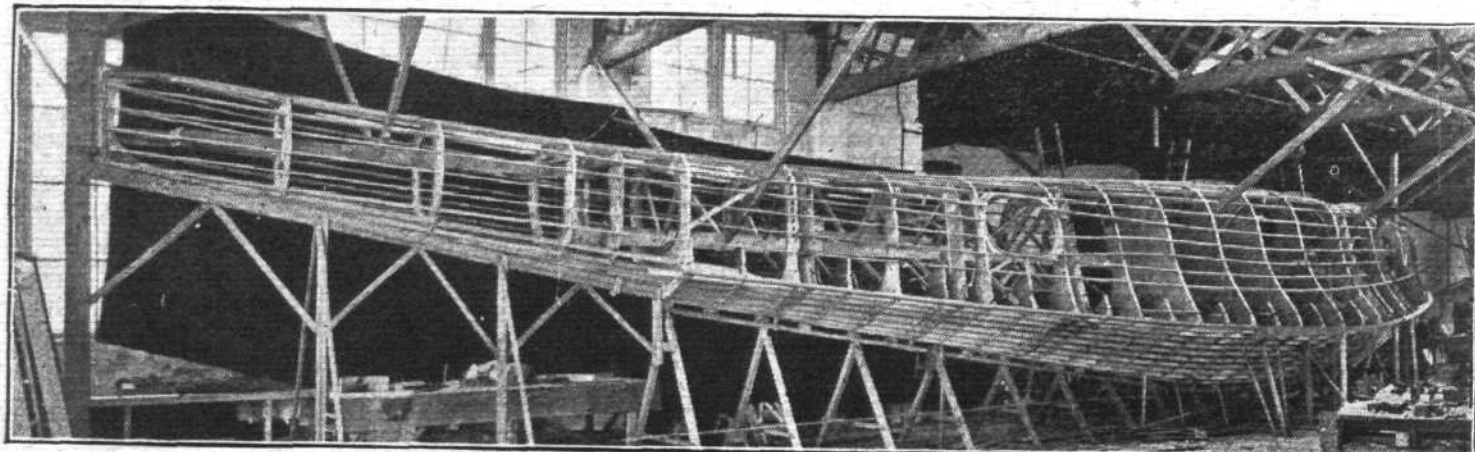


Fig. 13.—The hull of Nicholson N. 4



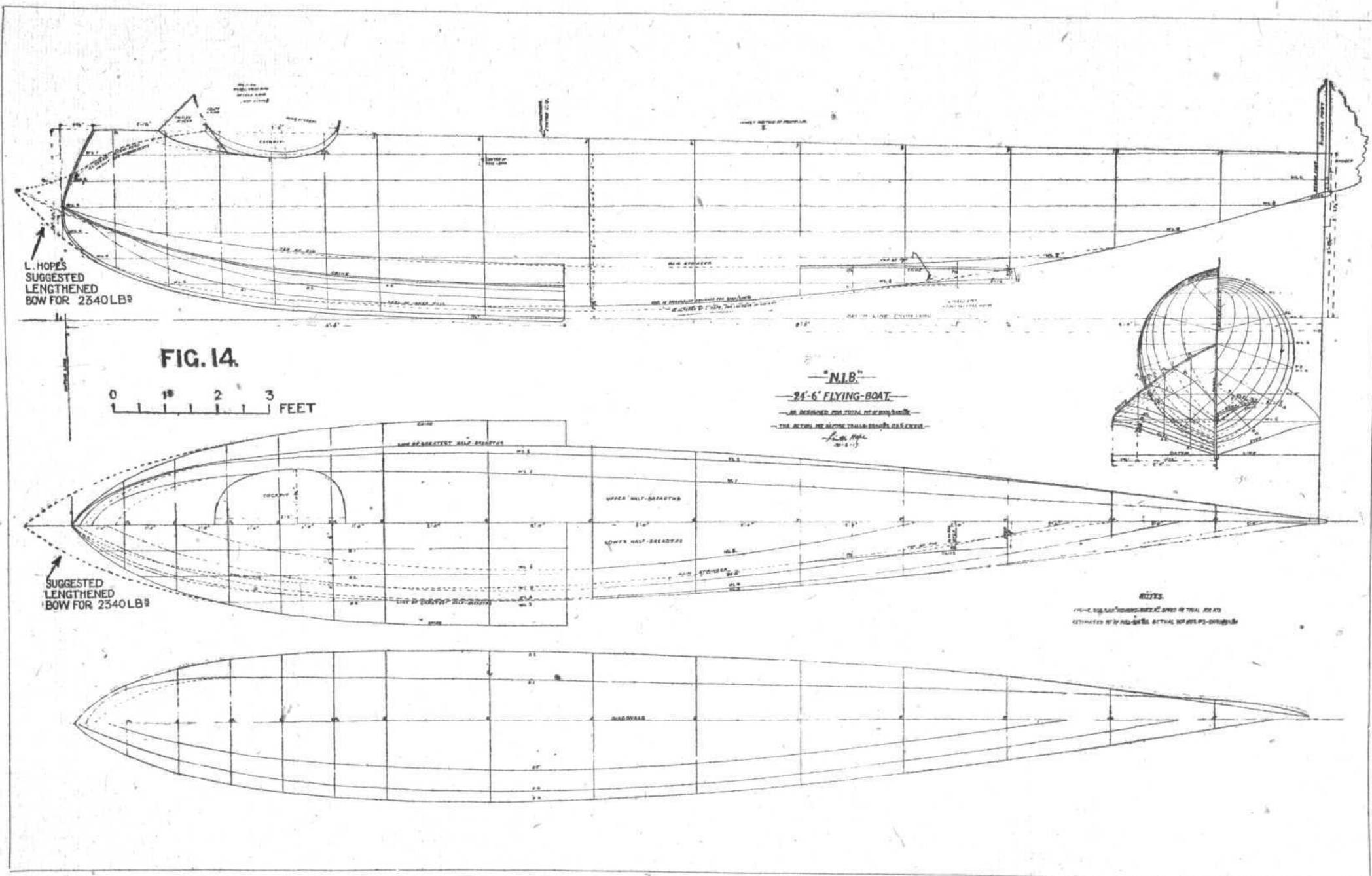


Fig. 14.—Lines of N. 1B, 24 ft. 6 ins. flying boat, as designed for total weight of 2,000–2,100 lbs. The actual weight before trials was 2,340 lbs., an excess of  $11\frac{1}{2}$  per cent.

# THE CANADIAN AIR BOARD

In view of its unique character, and to show what Canada is doing, we reproduce herewith the first report of the Canadian Air Board—that for the year ending March 31, 1920. The Canadian Air Board consists of the Rt. Hon. A. L. Sifton, P.C., K.C., Chairman; Mr. O. M. Biggar, K.C., Vice-Chairman; the Hon. S. C. Mewburn, C.M.G.; the Hon. C. C. Ballantyne; Dr. R. M. Coulter; Mr. J. A. Wilson; Mr. E. S. Busby; while the heads of branches are Lieut.-Col. R. Leckie, D.S.O., D.S.C., D.F.C., Superintendent of Flying Operations; Lieut.-Col. J. S. Scott, M.C., A.F.C., Superintendent of Certificates Branch; Major A. M. Shook, D.S.O., D.F.C., A.F.C., Secretary.

1. **General.**—The Air Board Act was assented to on June 6, 1919, and by Order in Council dated June 23 (P.C. 1295), the Hon. A. L. Sifton was named as Chairman of the Board, Col. O. M. Biggar, Judge Advocate-General, as Vice-Chairman; the Hon. S. C. Mewburn, Minister of Militia and Defence, as the representative on the Board of the Department of Militia and Defence; the Hon. C. C. Ballantyne, Minister of the Naval Service, as the representative on the Board of the Department of the Naval Service, and Dr. R. M. Coulter, C.M.G., Deputy Postmaster-General, Mr. J. A. Wilson, Assistant Deputy Minister, Department of the Naval Service, and Mr. E. S. Busby, Chief Inspector of the Department of Customs and Inland Revenue, as the remaining members of the Board.

The Board was called together immediately, and considered the organisation of a staff. After consultation with the Civil Service Commission, it was decided that the work under the Board should be divided into three branches, having at their heads respectively a Superintendent of Flying Operations, a Superintendent, Certificate Branch, and a Secretary, the proposal being that the Secretary should administer the internal office organisation, that the Superintendent of Flying Operations should control all civil government flying, and that the Superintendent of the Certificate Branch should conduct that portion of the administration which related to the public and was concerned with the licensing of personnel, aircraft and air harbours. The organisation thus outlined was formally communicated to the Civil Service Commission on July 15, with a request that provision should at once be made for the appointment of these three officers and a medical officer for the Certificate Branch. No appointments were, however, made until after some time, and the first appointees assumed their duties as follows:—on November 3, Lieut.-Col. J. Stanley Scott, M.C., A.F.C., Superintendent, Certificate Branch; on November 10, Major A. M. Shook, D.F.O., D.F.C., A.F.C., and Croix de Guerre, Secretary, and Capt. F. R. Smith, Medical Officer; and on December 15, Lieut.-Col. Robert Leckie, D.S.O., D.S.C., D.F.C., Superintendent of Flying Operations.

Permanent office accommodation was made available for the Board's staff only on December 24.

2. **Air Regulations.**—The only step which, before the appointment of technical officers, it was possible to take in the direction of regulating and controlling aerial navigation was to prohibit dangerous flying. An Order in Council for this purpose was passed on July 7 (P.C. 1379). The drafting of a complete set of regulations was, however, proceeded with, and was completed in time for their submission to and approval by the Governor in Council on December 31. The *Canada Gazette* containing the regulations was published on January 17, 1920, and at the same time there was ready for distribution a book containing not only the regulations, but also the forms settled for use under them, the Air Board Act and the Convention relating to International Air Navigation as drafted by a sub-commission constituted as part of the organisation of the Peace Conference and approved by the Supreme Council. This book has already had a wide distribution.

3. **Preliminary Surveys for Operations.**—In November steps were taken to have made a preliminary survey with a view to ascertaining what public services could more efficiently and in the broadest sense more economically, be performed by air than by existing methods. Canada was, for this purpose, divided into four parts, and ex-Royal Air Force officers borrowed or temporarily employed for the purpose. The survey was completed by the end of the year, and on January 2 these officers were assembled at Ottawa and the situation was thoroughly canvassed, with the result that it was decided that the most favourable fields for the commencement of operations were the less thickly settled and less thoroughly explored portions of Canada. An inter-departmental conference was accordingly held on January 10.

An agenda for this conference, including memoranda on the probable cost of operating aircraft and on their use for purposes of survey and for fire protection, was distributed, and a number of places were named as possible air stations, upon the utility of each of which discussion was invited. The usefulness of this preliminary conference was reduced by the non-participation of some of the departments which it was expected would be interested, but special discussions have since been carried on with those departments which were represented and some others. Proposals have been formulated for operations next summer.

4. **Scientific Research.**—Among the duties imposed upon the Board is that of undertaking technical research for the development of aeronautics and of co-operating for that purpose with other institutions. In execution of this duty, discussions took place with the Honorary Advisory Council for Scientific and Industrial Research, which resulted in the formation under that Council of an Associate Air Research Committee, which held its first meeting on February 7. Prof. A. S. Eve, Professor of Physics at McGill University, was selected as Chairman of the Committee, and Mr. R. J. Durley, Secretary of the Engineering Standards Association, as its Secretary. Other members of the Committee are Prof. J. C. McLennan, Professor of Physics at the University of Toronto, and Mr. J. R. Parkin, lecturer in the faculty of applied science in that university. This Committee will work in the closest co-operation with the officers of the Air Board, and will co-ordinate aeronautic research throughout Canada.

5. **Meteorological Development.**—The importance of meteorological information to air navigation cannot be over-estimated, and arrangements have been completed with Sir Frederick Stupart looking towards the necessary developments of the meteorological reports, the undertaking of meteorological observations at air stations operated under the Air Board, and the distribution of meteorological information.

6. **Wireless Installations and Navigators' Certificates.**—The development of air navigation will involve a considerable extension of wireless communication, and arrangements have been made with the General Superintendent, Government Radio Telegraph Service in the Department of Naval Service, for this purpose. Air pilots who require wireless qualifications will obtain them through that department, by which will be issued licences for the necessary installations both in aircraft and on the ground. That department has an organisation extending throughout Canada, and duplication of officers is thus avoided. Like arrangements are expected to be made with the Department of Marine and Fisheries for the issue of navigators' certificates to air pilots who desire or need them. The existing organisation under that department extends throughout Canada, and undertakes the examination and qualification of marine navigators. As the problems met with in air navigation are very similar to those which present themselves in marine navigation this arrangement is expected to be both economical and satisfactory.

7. **Aircraft and Equipment.**—Negotiations have been entered into looking towards the taking over by the Air Board of the seaplane stations erected during the War by the Department of the Naval Service at Halifax and Sydney, and that portion of Camp Borden which was developed as an aerodrome by the Royal Air Force and acquired by the Department of Militia and Defence after the conclusion of the War. The equipment, which will come under the control of the Air Board from these sources, has an estimated value of \$170,000. In addition to the aircraft and equipment thus acquired, 16 machines of an approximate value of \$100,000 are being received from the Air Ministry by way of replacement of those presented from time to time during the War to the Canadian forces through the activities of the Overseas Club, and the Imperial Government is also presenting to Canada aircraft and equipment of the value of about \$5,000,000, including 80 aeroplanes, 14 flying boats, 12 airships, 6 kite balloons with inflating plants and sheds, 300 motor and other vehicles and a substantial amount of armament, wireless instruments, cameras and other technical and general stores. A considerable part of this gift has already been shipped, and shipment of the remainder will not be long delayed.

8. **Mapping.**—At the request of the Air Board, the Dominion Geographer has commenced the preparation of aeronautical maps on the system laid down in the Convention relating to International Air Navigation. The process



of completing the mapping of Canada on this system will necessarily be a very long one.

9. **Canadian Air Force.**—The question of the constitution of a Canadian Air Force was an early subject of consideration by the Air Board, and on December 22 there was adopted, for submission to Privy Council, a memorandum covering the general lines of the organisation proposed. A final decision on this subject was, however, postponed until the general policy with regard to Canada's future sea, land and air forces was determined, and it has consequently not been possible to take any further steps in this direction. The very large number of ex-officers and airmen of the Royal Air Force in Canada are expected enthusiastically to support the proposals if it is found possible to adopt them.

10. **Aeronautic Intelligence.**—The Air Board Act imposes upon the Board a duty "to study the development of aeronautics in Canada and other countries." In the execution of this duty the Air Board has had the advantage of the work done before its constitution by the Intelligence Branch of the Canadian Air Force under the Ministry of Overseas

Military Forces of Canada. This branch, during the two years of its existence in London, had collected material of very great interest and value, and its papers were, in the course of demobilisation of the Canadian Expeditionary Force, transferred to the Air Board, which also secured the services of one of the officers chiefly responsible for its administration. The Air Board, consequently, has available fairly complete sets of drawings of almost all standard British machines, engines and equipment, with specifications for the construction of many of them, and has also an adequate collection of technical publications, reports and documents. The Intelligence Branch of the Canadian Air Force, O.M.F.C., established communication with the chief aircraft manufacturing companies, and this communication has been maintained, with the result that the Air Board secures early information of developments in design and of inventions having an importance from an aeronautical point of view. With this material it is able to deal with the problems which present themselves to commercial and other companies, and which require solution in connection with operations undertaken on behalf of the Government.

## CORRESPONDENCE

[The Editor does not hold himself responsible for opinions expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters intended for insertion in these columns.]

### THICK GERMAN WING SECTIONS

[2021] In your issue of April 15 you publish a few extracts from the German Technical Reports, as supplied by the Air Ministry. The data given in these extracts are somewhat misleading, as they refer only to wing sections of the "bird's-wing" type. In addition to those, a number of other thick sections were tested, more corresponding to actual practice. To show the difference I enclose the results of tests on a few of these as given in the "Technische Berichte." I will make no comments upon the figures, as they speak for themselves.

In the report on the Junkers monoplane mention was made of the word "Edul," stamped on the propeller (p. 420, April 15). As the meaning of this word may not be generally known the explanation may not be without interest. The word "Edul" is composed of the initial letters of "Entgegengesetz dem Uhrzeiger laufend" (anti-clockwise rotation). Sometimes the word "Mul" may be found on German props. This means: "Mit dem Uhrzeiger laufend" (clockwise rotation). The word "Zug" means traction, indicating that the screw is a tractor.

The following are the tables of data of thick wing sections:—

Section No. 298, corresponding to wings of Fokker triplane I.

Angle of Incidence. Degrees.	CA.	Cw.	Moment of c.p.	CA/Cw.
— 9	14.2	8.8	— 2.2	— 1.6
— 6	6.1	5.6	10.2	1.2
— 4.5	18.5	3.9	14.2	4.7
— 3	30.5	3.6	17.4	8.7
— 1.5	41.0	3.5	19.9	11.6
0	52.3	3.9	22.7	13.4
1.5	63.2	4.4	25.0	14.5
3	75.0	5.2	28.0	14.4
4.5	85.6	6.2	31.0	13.8
6	79.5	7.5	33.0	12.9
9	117.0	10.3	37.8	11.4
12	133.0	13.6	42.2	9.8
15	101.0	25.9	43.0	3.9

Figures in italics show max. CA and max. CA/Cw.  
Maximum thickness (percentage of chord), 12.6.

Section No. 256, corresponding to Junkers monoplane.

Angle of Incidence. Degrees.	CA.	Cw.	Moment of c.p.	CA/Cw.
— 9	8.7	5.7	7.6	— 1.5
— 6	7.8	3.2	11.9	2.5
— 4.5	17.0	3.0	13.9	5.7
— 3	26.9	2.9	16.2	9.2
— 1.5	36.5	3.1	18.6	11.8
0	51.1	3.9	22.7	13.2
1.5	63.4	4.8	26.5	13.0
3	73.2	5.8	28.9	12.5
4.5	81.3	7.0	30.8	11.7
6	91.2	8.3	32.6	10.9
9	106.7	11.0	35.6	9.7
12	120.0	14.0	38.0	8.6
15	121.8	19.5	37.8	6.8

Maximum thickness (percentage of chord), 16.3.

Section No. 322, corresponding to Hansa-Brandenburg IV 2.

Angle of Incidence.	CA.	Cw.	Moment of c.p.	CA/Cw.
— 9	13.3	9.8	— 3.2	— 1.4
— 6	5.0	6.7	3.9	— 0.7
— 4.5	8.1	5.2	9.5	1.6
— 3	20.3	4.2	13.2	4.9
— 1.5	31.9	3.7	15.4	8.6
0	43.6	3.8	18.2	11.2
1.5	54.6	4.0	20.7	13.4
3	66.2	4.6	23.6	14.3
4.5	77.5	5.6	26.0	14.0
6	90.1	6.7	29.1	13.5
9	111.5	9.3	34.2	12.0
12	131.7	12.7	38.7	10.4
15	144.1	16.9	41.8	8.6

Maximum thickness (percentage of chord), 13.3.

Section No. 332, corresponding to Pfalz 61.

Angle of Incidence.	CA.	Cw.	Moment of c.p.	CA/Cw.
— 9	9.3	10.2	0.4	— 0.9
— 6	4.6	7.13	9.6	0.6
— 4.5	16.6	5.71	15.5	2.9
— 3.0	27.4	4.64	19.7	6.4
— 1.5	41.7	4.23	22.8	9.9
0	53.6	4.40	25.5	12.2
1.5	64.0	4.71	28.1	13.6
3	75.9	5.34	30.6	14.2
4.5	86.7	6.00	33.0	14.4
6	98.4	7.73	35.5	12.7
9	118.5	10.4	40.3	11.4
12	137.6	13.7	44.2	10.0
15	151.0	17.6	47.7	8.6

Maximum thickness (percentage of chord), 11.7.

CA = Lift coefficient. Cw = Drag coefficient, and CA/Cw = L/D.  
Rotterdam.

F. H. R.

### VISIBILITY AT HEIGHTS

[2022] In your issue of April 22 on page 453, you quote statements concerning the distance to the horizon from different heights and the time occupied by parachutes in descending.

May I point out that "Aeronaut," whom you quote, and also Major Orde Lees, in a later issue, are incorrect. The distance of the horizon is found by the following formula:—

$$\text{Distance (miles)} = 1.42 \sqrt{\text{Height (feet)}}$$

"About 100 miles at 5,000 ft.," allowing for refraction, is not far out. Major Orde Lees' statement that at a height of 12 miles an object 250 miles away is the farthest that can be seen is wrong; it is about 310 miles.

As regards parachute descents, whilst it is probable that the Frau Poitevin record is incorrect, there are many cases of reported longer descents than according to the supposed rule. Moedebeck ascribes them to the influence of upward currents. The late A. E. Gaudron claimed to have taken 20 minutes to come down from 10,000 ft. on one occasion.

By the way, Major Orde Lees' estimate of horizon distance is accounted for by the fact that he gives the wrong formula. He puts it at:—Distance =  $\sqrt{\text{Height (ft.)}}$ .

P. H.

## AIRISMS FROM THE FOUR WINDS

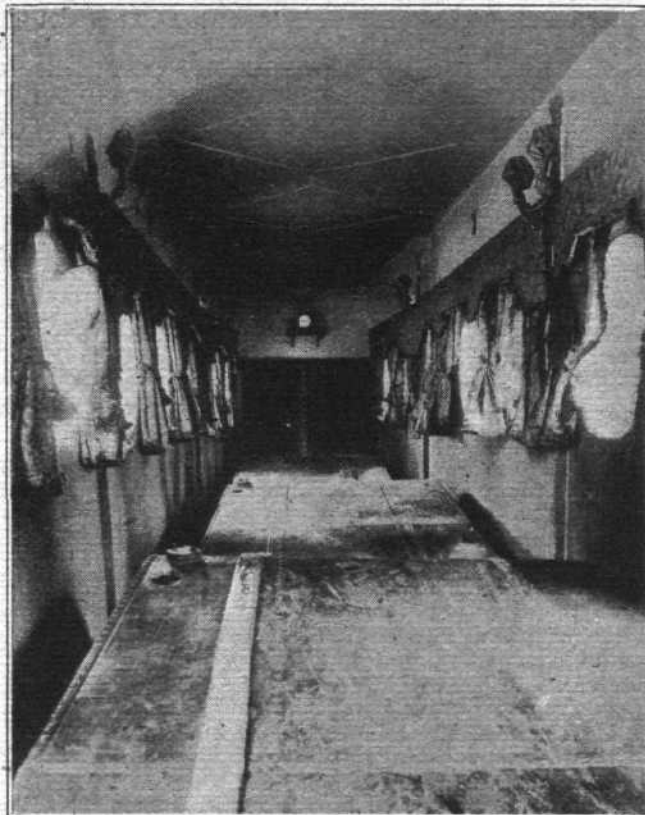
So at last it looks as if that Territorial Air Force is to be. It is authoritatively stated that plans have been approved and passed from the Air Ministry for the consideration of the Secretary of State for War and Air. If the basis for the formation of this body has been drawn up in a sufficiently broad spirit in keeping with the art of aviation itself, the foundation of the Royal Air Terriers will, in our view, mark one of the most important "milestones" in helping along the art in a practical form which has been carried through since the Armistice. It should mean the broadening out of aviation in every direction and a glorious resurrection of the almost defunct industry. As a means of keeping together for the good of the Empire the magnificent nucleus of *personnel* which was created by the War, and of building up a flying reserve of high-grade pilots for any emergency, a standing Territorial Air Force would be hard to beat. Accepting this sign of progress as significant fact, our congratulations to all concerned.

In aid of the Royal Air Force War Memorial Fund a great aerial pageant is likely to be holden at Hendon Aerodrome on July 3. It is to be hoped this may mark the re-inauguration of the old-time popularity of London's great and regular aerial race meetings.

WHITSUN holidays saw Glasgow citizens being regularly conveyed to Gleneagles, Perthshire, a distance of 47 miles, to witness the big professional golf tournament being played off. Probably even more important in the eyes of the northerners was the "ticketing" of the great professionals, thereby enabling the cautious punter to follow the man who was carrying his money.

THOSE artistic village signs which are just now so much to the fore are seemingly of interest even to the aircraft world. A Potters Bar resident has suggested that one of the competing artists for the *Daily Mail* prizes should choose a broken Zeppelin as the essential feature for that village's name-plate. (L. 31 was destroyed there on October 2, 1916.)

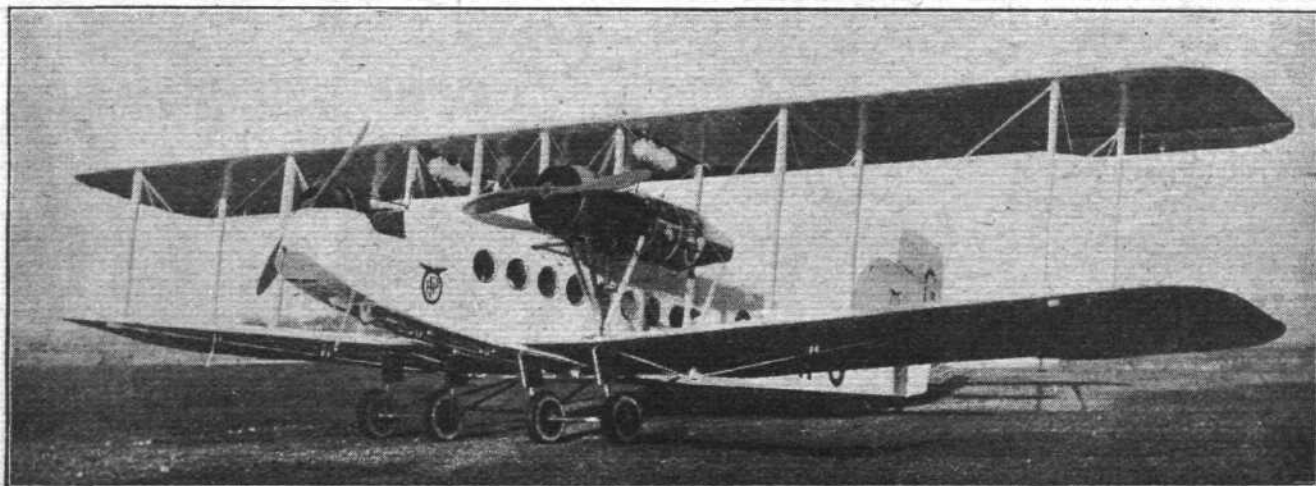
ON the other hand, there does not appear to be an overwhelming desire to perpetuate the memories of the German aerial outrages on London and elsewhere which it was at one time suggested should be done in every direction. Westminster City Council, for instance, which at one time contemplated placing memorial tablets on all premises in the city struck by German bombs, recently decided to mark only the first and last buildings so hit. The Lyceum Theatre was the last, but the directors do not approve the Council's plan—and have said so. Further, the occupiers of the first building hit have suggested for their tablet a position so lofty as to be



The interior of the Handley Page W. 8 as fitted up for ballast tanks when up for record

unsuitable. In view of these objections, and the fact that such tablets would now cost £30 each, we are told the City Council are adjourning action *sine die*.

SANDERSTEAD, near Croydon, has demonstrated its views upon War memorials. Last week, Captain A. F. B. Carpenter, V.C., who commanded the "Vindictive" at Zeebrugge, and Air Commodore Hearson unveiled a granite Celtic cross of 15th century design in the village churchyard as a War memorial. The cross, which stands near the road, was dedicated by the Archdeacon of Kingston, and bears the



**A FINE RECORD:** The Handley Page W. 8, two Napier "Lion" engines, which recently established a British record by lifting a useful load of 3,690 lbs. to an altitude of (official) 13,999 ft. We have no official information as to whether it was the barograph or the c.g. of the machine, or the c.g. of the useful load which reached this altitude. The duration of the flight was 1 hour 20 minutes





following inscription:—"All ye who pass by, remember with gratitude the men of this place who went forth to fight for God's country."

AIR VICE-MARSHAL SIR WILLIAM SALMOND'S mission in Mesopotamia is fraught with great hope. He is touring the country extensively for the purpose of locating positions for new posts for the Government, so that aircraft may be used in a much more extended form for the economising of troops, as foreshadowed awhile back in connection with the introduction of the Army Estimates. Sir William's recommendations are sure to be sound, and it is to be hoped they will be acted upon in their entirety.

We do not fancy there should be much difficulty in finding passengers for the rehearsal trip for the Round the World Derby which the Aero Club and Aerial League of America hope to bring into practical form. If the passengers have to provide their own expenses, possibly it may not be quite so crowded a list of applicants. But even then we can imagine there are plenty of sportsmen who will be found ready to take their chance.

Major C. J. Glidden, the officer in charge of this projected First Aerial Derby Round the World, which it is hoped to hold in 1921 has sent out a world-wide invitation for volunteer passengers who are willing to make a test flight round the world this year, covering all points except crossing the Atlantic and Pacific Oceans. The passengers are to keep a record of their flying time between points, which will be used as a basis in the race, and so will aid materially in arranging the rules for the Derby.

Transportation negotiations are being made with firms

having the necessary facilities to arrange transportation from:—

	Miles.
New York to Seattle .. .. .	2,929
Yokohama to Shanghai .. .. .	1,265
Shanghai to Bangkok via Hong-kong, Canton, and Hanoi .. .. .	2,096
Bangkok to Baghdad via Rangoon, Calcutta, and Karachi .. .. .	2,563
Baghdad to Dummery Head, Ireland, via Aleppo, Adalia, Salonika, Rome, Paris and London .. .. .	3,404

Total (approximately) .. .. . 12,257

Two passengers are sought, one willing to travel east and the other west.

Who makes first bid?

If report is to be believed Sir Thomas Lipton will see "Shamrock IV" compete in the America Cup races this summer from a flying boat. The Curtiss Company invited him to use one of their Seagulls for the purpose, and we understand Sir Thomas has now accepted this invitation to watch from the air his craft we hope, win the trophy for Great Britain.

NATURE, evidently spurred on by envy to emulate man's progress in the air, has now produced a biplane rooster. It appears that a chicken belonging to Mr. Franklyn of Ash Vale, Guildford, has been hatched with four legs, four wings and two necks. So now we may expect the next stage to be a triplane bird. And what a vista this must open up to the popular restaurateur whose ever-present problem is to satisfy all his customers with wings.

## ROYAL AERONAUTICAL SOCIETY NOTICES



**Election of Members.**—The following Members were elected in the various grades as shown at a Council Meeting held on May 18.

**Fellow:** R. McKinnon Wood. **Associate Fellows:** F. P. H. Beadle, Capt. H. R. Gillman, A. A. Grone, G. Ham, Lieut. P. H. Harrower, Squad. Ldr. R. M. Hill, M.C., A.F.C., Capt. W. S. Hiscocks, V. J. Johnston, Major F. R. McMahon, F. Murphy, B.Sc., Wing-Com. H. W. S. Outram, C.B.E.

**Members:** A. Brown, R. L. Carton, D. A. Gortley-Jones, Sec. Lieut. S. Kirtkar, Flying Officer G. W. Longstaff, H. P. Marsh, J.P., Flying Officer F. A. Norton, G. A. Parsons, Lieut. J. H. L. Purkess. **Associate Members:** C. G. Brown, G. P. Ford, P. N. Rao. **Students:** A. N. Jackson, O. E. Simmonds. **Foreign Members:** Com. E. S. Land, U.S.N., Assistant U.S. Naval Attaché.

**Wilbur Wright Lecture.**—Members desiring to attend themselves, and bring friends to, the Wilbur Wright Lecture, should make application to the Secretary for reserved seats which will be allotted in the order of application. The Lecture will commence at 8.30 p.m. at the Central Hall, Westminster, on Tuesday, June 22; the title of Com. Hun-

saker's paper being "Naval Architecture in Aeronautics." H.R.H. Prince Albert will take the Chair.

**Examinations.**—The Examinations Committee have presented a preliminary report to the Council on the qualifications for Associate Fellowship which should be accepted in lieu of the Society's own examinations.

These are grouped under three heads: (a) General Education, (b) Technical Qualifications, (c) Aeronautical Qualifications. In addition it is recommended that an age limit should be fixed and a certain number of years' experience in the application of science to aeronautics.

**Lectures.**—The Council have decided upon certain modifications in the arrangements for lectures during the next Autumn Session. It is proposed to try the experiment of holding them at 5.30 in the afternoon in place of in the evening as heretofore. Details will be found in the June issue of the *Aeronautical Journal*.

**Journal.**—The June issue of the *Aeronautical Journal* will contain full reports, together with discussions, of Capt. Acland's paper on "Trans-Continental Flying," and Sir Sefton Brancker's paper on "Aerial Transport from the Business Point of View."

W. LOCKWOOD MARSH, Secretary

## AVIATION IN PARLIAMENT

### Aeronautical Engineering Instruction

MR. HOPKINS, in the House of Commons on May 17, asked the Secretary of State for War and Air what are the centres at which demobilised officers and men of the Air Service can obtain at the present time instruction in aeronautical engineering; whether the facilities at the centres in question are adequate; and to what extent the Air Ministry or other Government Department is at the present time giving financial or other assistance to these centres for the specific purpose of developing instruction in aeronautical engineering?

MR. CHURCHILL: The whole question of education and research in aeronautics was considered by a Committee under the Chairmanship of Sir Richard Glazebrook. My hon. friend can obtain a copy of this Committee's Report dated December 12 last, which has been adopted by the Government and which sets forth proposals for the establishment of a School of Aeronautics at the Imperial College, South Kensington. Instruction in the subject is also given, I understand, at East London College and at Cambridge University. I do not think it is possible to say at this stage whether the facilities provided will prove to be adequate. With regard to the last part of the question, my hon. friend will find that the Report provides for an annual expenditure of approximately £10,000 in connection with the South Kensington scheme. This charge will be borne, during the current year, by the Department of Scientific and Industrial Research.

### R.A.F. Married Establishment (Egypt)

COL. BURN on May 18 asked the Secretary of State for Air what arrangements have been made in accordance with promises given to enable the wives of non-commissioned officers and men serving in the Royal Air Force in Egypt to join their husbands; and whether accommodation is provided in that country?

MR. CHURCHILL: As stated in the reply given on March 9 to the hon. and gallant Member for North Bradford, the question of a Married Establishment for the Royal Air Force is under consideration, and efforts are being made to obtain a decision as soon as possible.

COL. BURN: The matter has already been a very long time under consideration, and the delay is causing very great inconvenience to those concerned. Will the right hon. gentleman hasten things?

MR. CHURCHILL: I will do my best.

### The Handley Page Wing

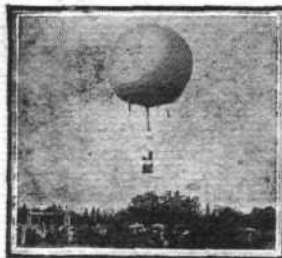
CAPT. W. BENN asked the Secretary of State for Air whether there was any intention on the part of the Government to observe secrecy in the matter of the Handley Page wing improvement, or whether any facts in possession of the Government would be made public for the benefit of aviation in all countries?

MR. CHURCHILL: The invention is a private one, and is the property of the Handley Page Co. Such information in regard to the design as is in the possession of the Air Ministry was communicated by the firm confidentially, and I am not prepared to take the step which the hon. and gallant member suggests.

### Air Mail Service, France and Holland

MRS. SUGDEN on May 19 asked the Postmaster-General what increases, if any, have obtained in quantity and territory of the delivery of letters by aircraft during the periods 1918-19 and 1919-20; if steps are being taken to deal with parcel post by aircraft; and what is the comparison of cost between this speedier method of delivery and that previously obtaining in respect to letters and parcels?

MR. ILLINGWORTH: An Air Mail Service between London and Paris has been maintained since November, 1919, and is available for the transmission from the United Kingdom of letters, postcards, printed papers, commercial papers and samples for France and countries served through France, such as Switzerland, Italy, Spain and Portugal. Until recently there was a single service daily in each direction with a mid-day departure, but since the 12th instant there have been two services daily from London with morning and afternoon departures. The special fee charged, in addition to the ordinary foreign postage, for the transmission of postal packets by air to Paris was originally fixed at 2s. 6d. per ounce, which covered express delivery in the country of destination. It has recently been altered to 2s. per ounce, to which is added 6d. per packet if express delivery is desired. These charges cover the actual additional cost of the service to the Post Office. I hope that the arrangements which I have been concerting with the Dutch Post Office for the establishment of an Air Mail Service between this country and Holland will soon be completed, and that it will also be possible to establish a similar service with Belgium at no distant date. It is not intended at present to arrange for the transmission of parcel mails by air.



# AIRSHIPS



## RIGID AIRSHIPS AND THEIR DEVELOPMENT

BY J. E. M. PRITCHARD, M.A., F.G.S.

(Continued from page 557.)

### Fabric.

**Outer cover.**—One of the chief functions of an outer cover is to provide a smooth streamline form. It is, therefore, necessary that the fabric should be tightly stretched under all conditions of temperature and humidity. If, in flight the outer cover sections sag in between the transverse frames owing to wind pressure, as much as three or four miles an hour are taken off the maximum speed of the ship owing to increased resistance.

Again, to obtain an outer cover with a long life, it is essential that it should be tightly stretched, so that it does not flap during flight when the ship is passing through disturbed air and the pressure distribution along the hull is changing rapidly. This tendency to flap can be decreased by providing adequate attachments to the diagonal hull wiring as well as to the girders, also by using a stiff dope which tends to prevent the formation of wave motion in the fabric. The great point to be realised in outer covers is that when dry the dope must absolutely control the fabric and not the fabric the dope. When wet the fabric should contract and assist the dope. A fabric should, therefore, be chosen which contracts strongly when wet, otherwise, under varying conditions of temperature and humidity, the outer cover alternately tautens or slacks off, with disastrous results. For short flights this would be only a matter of inconvenience and high maintenance charges due to the rapidity with which the fabric would wear out, as after each flight the dope would regain control and tauten up the fabric after the ship had returned to her shed; but for long-distance flights it is a matter of prime importance that the outer cover should be most reliable. All kinds of weather conditions may be experienced, and if the outer cover failed during such a flight the ship might easily be completely wrecked.

Various dopes have been tried. Latterly the base of all outer cover dopes is some form of cellulose acetate, although, aside from its inflammability, nitro-cellulose appears to possess many advantages over cellulose acetate. The type of cellulose acetate used appears to be of great importance. In general, it would appear that the more soluble the cellulose acetate the less tough will be the resulting dope film.

Owing to the constant vibration of the fabric during flight, and the varying weather conditions met with, it is necessary that the dope should possess great adhesion to the outer cover. With certain dopes this can, however, be carried to too great an extent. If, for example, the fabric is thoroughly saturated in certain dopes by passing the fabric first through a vacuum and then through the dope baths under pressure, the fabric tends to tear much more readily. The dope should, therefore, be so applied that it enters thoroughly into the texture of the fabric, but does not actually completely fill all the interstices in the actual yarn.

The inner surface of the outer covers has generally been treated with a light coat of paraffin wax in the order of 2 g/m<sup>2</sup>, as it was thought to prevent the absorption of moisture by the fabric on its inner side.

The dope requirements are manifold. It must be water repellent, and must also be as insoluble as possible, otherwise water is absorbed and the dope speedily loses control of the fabric, and, in extreme cases, actually washes off. For this reason it is generally considered desirable to apply one or more coats of varnish on top of the dope to increase the water repellent qualities of the dope. With badly doped outer covers ships of only 1,000,000 cubic ft. capacity (half the capacity of R 34) have absorbed as much as 3 tons of water during a heavy shower.

The outer cover must also reflect the heat rays to prevent superheating, and the ultra-violet rays to prevent deterioration in the fabric of the gasbag. It should be pointed out in this connection that the arrangement in rigids of two distinct layers of fabric, each specially prepared for its special function,

namely, the outer cover fabric and the gasbags separated by an air space of some 6 ins. to 1 ft., allows for far better results being obtained than is possible in non-rigids, or semi-rigids, where both functions have to be combined in a single fabric.

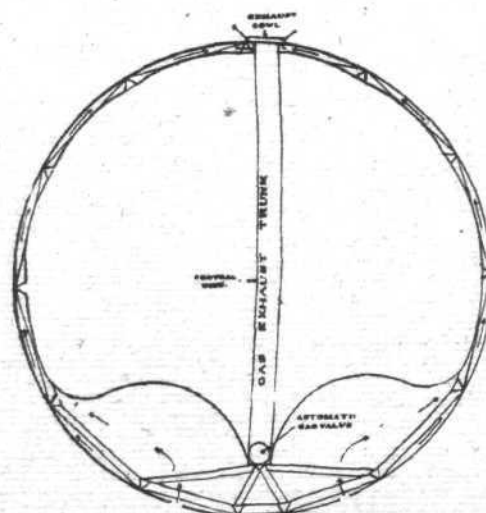
Superheating is of very great importance. During the summer months 20° Fahr. of superheating is frequently experienced with the present outer covers. This means, for a ship of 2,000,000 cubic ft. capacity, an increase in buoyancy of about 2 tons when no gas is expelled, or a corresponding loss of gas should the gasbags be full. The best methods of preventing superheating appear to be:—

(1) To reflect as many of the heat rays as possible by mixing aluminium powder with the dope or varnish. It is necessary that the aluminium should be very evenly applied, and the outer cover should be extremely glossy. For this reason there is a distinct advantage in applying a little aluminium with each coat of dope, and not adding it solely to the last coat. It should be noted, however, that the admixture of aluminium powder to the dope lessens the adhesion of the dope films, although it increases its water repellent qualities. It would, therefore, appear more advantageous to concentrate all the aluminium in the last one or two coats. The effect of varnish is of advantage, as it tends to produce a more glossy, reflecting surface, and thus increases the reflecting qualities of the outer cover. Varnish also increases the water repellent qualities of the outer cover, and protects the dope from the softening action of rain.

(2) It is of importance that all heat which is not actually reflected by the outer cover should be absorbed by it, and not allowed to pass through to the gas bag fabric, where it must inevitably heat the gas. It is, therefore, theoretically desirable that some form of dark-coloured dye should be added to absorb this heat, or that the first one or two coats should be mixed with pigment such as yellow ochre or red oxide of iron. It is probably not desirable to apply the dye actually to the fabric itself, as all dyes so far experimented with tend to weaken the strength of the fabric, and if dye is used at all it will probably be mixed with the first coat or two of dope, the aluminium being added to the final coats. If the aluminium is applied as a sufficiently even and dense coat, however, it does away to a great extent with the necessity of adding dye to the early coats.

(3) A certain amount of heat will not be reflected, and will

### VERTICAL SYSTEM OF VENTILATION



Ventilation system to reduce superheating



pass through the outer cover. As much of this as possible should be prevented from being absorbed by the gasbags by arranging a uniform and brisk system of ventilation between the outer cover and the gasbags. The amount of heat that passes through the outer cover will, to some extent, depend on the speed with which the ship is passing through the air. Naturally, the faster the ship travels the greater is the cooling effect of the air rushing past the outside of the outer cover.

Superheating causes even more inconvenience when the ship is moored out than in flight. It is necessary that any ventilation system provided to carry off the heat from the outer cover before it warms the 6 in. or so of air between the outer cover and the gasbag should be so arranged that it is approximately as brisk when the ship is stationary at a mooring mast as when flying through the air at, say, 50 or 60 knots. For this reason it seems probable that the best arrangement will be to provide air intake apertures along the under portion of the hull, and air outlets at the top of the ship with small hoods opening aft and protruding possibly three or four inches above the top of the ship. It has been suggested that, owing to the large number of excrescences along the top of the ship caused by these hoods and by the hoods for the manoeuvring and automatic gas valves, it might be an appreciable saving in resistance to construct a small ridge right along the top of the ship which would contain all the various outlets, so arranged that there would be a slight suction due to passage through the air and at the same time prevent rain entering the ship.

A great advantage of any vertical system of ventilation as outlined above is that when the ship is stationary at a mooring mast during sunny weather, the heat not reflected by the outer cover will be absorbed, and will raise the temperature of the outer cover, which will in turn warm the layer of air between it and the gasbags. This layer of warm air will cause a differ-

preferred. Unfortunately many dopes, cellulose acetate dope in particular, cannot be applied by this method, especially if they contain a large admixture of aluminium.

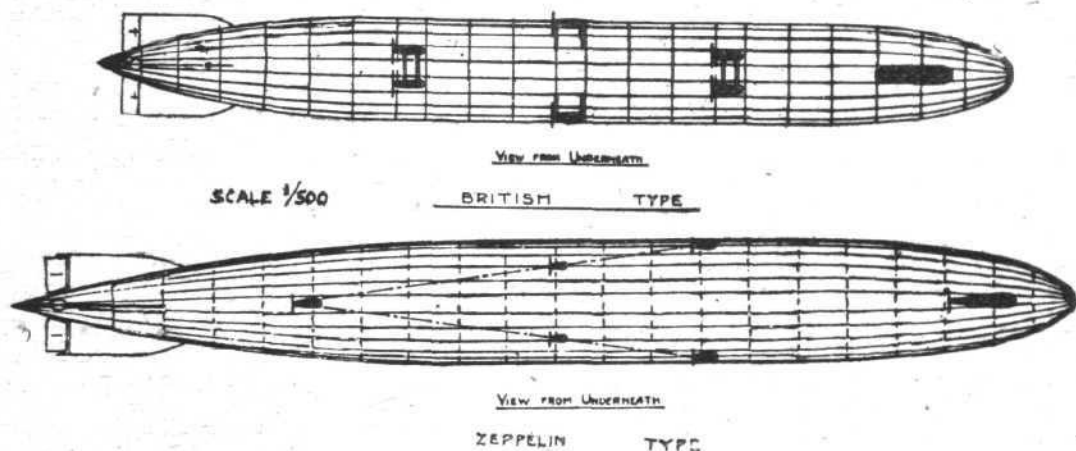
A point to be considered is the admission of light to the corridor, which will be almost in complete darkness if a dense aluminium surface is applied to the outer cover. As most of the superheating is caused by the sun's rays striking the upper surface of the outer cover, probably the best method is to provide a strip of outer cover running along the bottom of the hull doped with transparent dope. This portion should anyway be varnished to increase its water repellent qualities.

Specially thick panels are fitted in way of each propeller. This is necessary, due to the disturbed nature of the ship stream, and further, in cold weather, it is possible to damage seriously the thin outer cover, owing to small fragments of ice being driven against the outer cover by the propellers.

#### Gasbags.

The main problem in rigid gasbags is to obtain a light and strong fabric which is, at the same time, sufficiently gastight. The greatest tension is naturally applied to the upper part of the gasbag owing to the differential pressure between the gas and air. In the case of future ships of larger diameter, economy can probably be effected by constructing a composite bag with thicker fabric in its upper portion. The fabrics at present in use are either fine cotton of from 50 to 85 gms. in weight, or fine silk approximately 30 gms. in weight.

Gasbags in this country are usually constructed of single-ply cotton, and are covered on their inner surface with a single layer of goldbeater skin attached to the fabric with rubber solution, except at the extreme top, where two layers are used. The skin is then covered with varnish to prevent absorption of moisture during damp weather. In the older ships of the 23 class as much as one ton loss in lift appears to have been sustained, due to absorption of water by the gasbags.



General car arrangement.

(a) British; (b) Zeppelin

ential pressure proportional to the diameter of the ship, and a steady current of air should, therefore, pass through the space between the outer cover and the gasbag, the cold air entering at the intake ports in the lower surface of the ship, the hot air passing out through the exhaust ports at the top. As the temperature increases, the rate of ventilation will naturally increase, and the cooling effect will, therefore, be more or less automatic, and will increase as the superheating becomes more pronounced.

The early outer covers used in England were made of linen. This fabric was used on account of its great tensile strength in relation to its weight. The balance of opinion now, however, is in favour of mercerised cotton outer covers. To assist the dope in wet weather it is, however, of importance that a fabric should be chosen which contracts strongly when wet, and in this respect mercerised cotton appears to be superior to ordinary cotton or to linen.

In early ships the outer covers were completely doped at the fabric works before being attached to the ship. This arrangement is most undesirable owing to the damage to the dope film during transit from the fabric works to the airship construction station, and to subsequent damage during attachment to the ship. The difficulty of obtaining the correct tension is also considerable.

The present practice is to apply mechanically one to three coats to the fabric, which is then made up into panels of various sizes ready for lacing. The outer cover is then attached to the ship, and one or more final coats of dope or solvent are then applied *in situ* to produce the necessary tension in the outer cover, and a subsequent coat of varnish to give a more water repellent and glossy surface may also be applied *in situ*.

The two methods of applying dope *in situ* are by brush or by compressed-air spraying-machines. The second produces much more even doping, and in this respect is much to be

In Germany it is customary to use somewhat lighter gasbag fabric than in this country and two layers of goldbeater skin, and the goldbeater skin is attached to the fabric by a kind of glue. As far as can be seen, the glue offers no advantage over rubber, and is probably used owing to the extreme scarcity of rubber. In German gasbags the two layers of skins appear to be regarded as providing the requisite strength as well as the gastightness, and the main function of the outer layer of thin fabric (cotton or Japanese silk) is to protect the skins from abrasion.

Although the goldbeater skin forms an extremely light and efficient gas-container, it is, nevertheless, a most undesirable material. In the first place, the supply of skins is limited, as only one skin is obtained per animal. Some 600,000 skins are used per rigid of the 33 class to provide a single layer of skins. The cost of this is appreciable, as skins at present are worth about 1½d. each, and the amount of labour employed in scrubbing, cleaning, and applying these skins to the fabric is excessive. In fact, the total cost of a complete set of skin-lined gasbags is at present not far short of £40,000.

Many attempts have been made to obtain a light gastight fabric by means of flexible dope, and experiments have reached such a stage that it can be assumed without undue optimism that it is only a matter of a short time before it will be possible to use a light flexible dope applied to single-ply cotton fabric. The total weights of a typical British gasbag fabric are as follows:—

Single-ply goldbeater skin	..	18—20 gms./m <sup>2</sup> .
Rubber { adhesive	..	40—45 "
proofing	..	20 "
Varnish	..	8—10 "
Cotton	..	75 "
Total	..	161—170 gms./m <sup>2</sup> .



Forward combined control and engine car, Zeppelin

There is every possibility that it will be practical to use even lighter fabric, of, say, 50 gms./m<sup>2</sup> for Service rigids where the last ounce of efficiency is of the utmost importance. Owing to the risk of damaging this fabric and the extra cost of obtaining such very finely woven cotton, it is probable that, for commercial ships, heavier fabric will be used.

A curious feature in gasbags is that they maintain their gas-containing properties for a reasonable time, and then suddenly become porous. In nearly every case the gasbag has to be removed within a fortnight of the beginning of this sudden collapse in its gastight qualities. Generally speaking, the gasbags last about two years.

The automatic valves have now reached about the limit in size, having regard to their very light construction.

In rigids larger than 2,000,000 cubic ft. capacity it is probably best to fit two automatic valves instead of one, situated at the bottom of the butt end of each gasbag.

Too great stress cannot be laid on the extreme importance of gasbags blowing off at a more or less uniform pressure.

Naturally, the pressure at which the gas valves blow off is higher at the ends of ship than midships.

Automatic Gas Valve Settings

Gasbag No.	No. of Valves.	Diameter of Valve Discs in m/m.	Valve setting in m/m. of water pressure.
XVIII	I	Small valve 545	16
XVII	I	" " 545	16
XVI	I	" " 545	13
XV	I	" " 545	13
XIV	I	" " 545	10
XIII	I	Large 800	10
XII	I	" " 800	9
XI	I	" " 800	9
X	I	" " 800	9
IX	I	" " 800	9
VIII	I	" " 800	9
VII	I	" " 800	9
VI	I	" " 800	9
V	I	" " 800	9
IV	I	" " 800	9.5
III	I	" " 800	9.5
II	I	Small " 545	13
I	I	" " 545	13

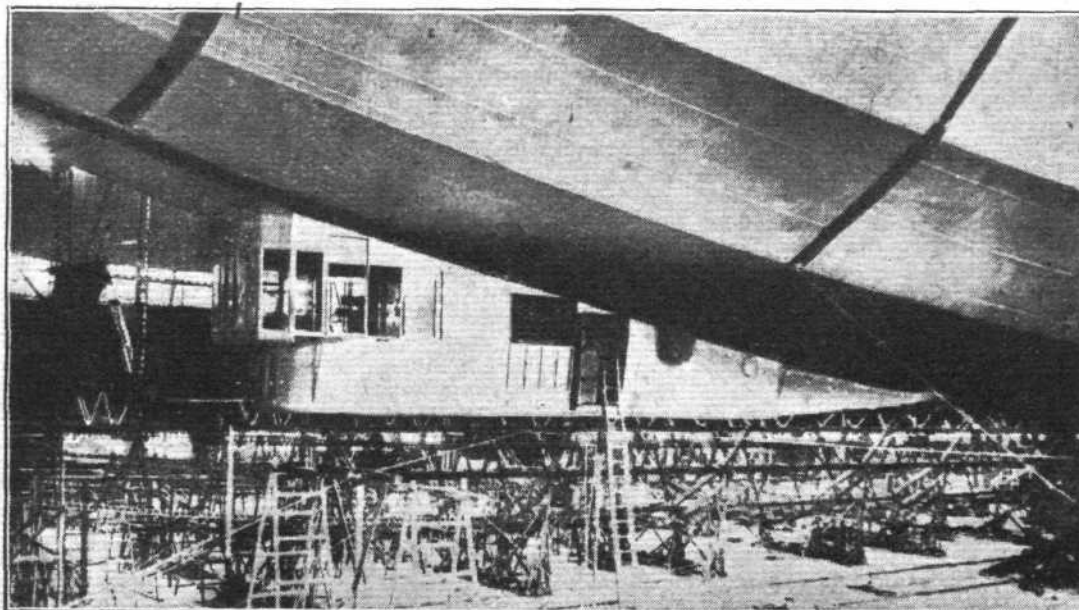
Cars.

*General Car Arrangement.*—In rigid airships it is obviously undesirable to concentrate too much weight at any one point. For this reason it is necessary to split up the total amount of power required into several distinct propelling units, bearing always in mind, however, modifying factors such as the horse-power of available prime movers, propeller efficiency, maximum weight and thrust which can be concentrated conveniently at any one point, and the number of units required to give the requisite reliability.

Several systems of car arrangement have been in vogue from time to time.

*The Zeppelin Company's* arrangement is to fit one large composite centre line car forward, containing in its front end the control and observation car. A car containing a power unit is fitted immediately behind the control car, the two cars being separated by a space of about 1 in. to prevent much of the noise and vibration passing from the power car into the control car. The wireless cabin is situated in the after part of the control car. A second centre line car is fitted well aft, containing a power unit. Between these two cars are fitted one or more pairs of small wing cars arranged at varying distances from the centre line of the ship, to prevent slip-stream interference. The forward and after cars are also fitted with buffer bags and handrails, and are used as the two points of contact for handling purposes on the landing ground. The accompanying diagram of the car disposition of the German L 70 class illustrates this type of general arrangement (p. 579).

*The British* system, except where German practice has been copied, provides for one small centre line control car fitted well forward. In some cases it can hardly be regarded as a car in the strict sense of the word, but rather as an excrescence built out from the internal keel of the ship where the bow begins to rise. This car only contains the control



R 31 control car  
[(British system)]



gear and wireless cabinet. Aft of this, two or more pairs of wing cars are fitted at varying distances from the centre line of the ship to prevent the slipstreams of the forward cars blowing on to the after units, thus increasing head resistance. On the landing ground, the ship would generally be supported at its forward end by the control car, and at the after end by a pair of wing cars. In certain cases, however, the control car is fitted so far forward that it is always well off the ground, in which case the bow of the ship is supported on the landing ground by the forward pair of wing cars.

The present tendency in England is to regard this system as the more efficient. In the first place, the overall height of the ship can be appreciably reduced. In the Zeppelin type the overall height must be about 13 ft. more than the maximum diameter. In the British arrangement, it is possible to bring the overall height down almost indefinitely, so that in an extreme case it would be no greater than the maximum diameter of the hull. In practice, however, it is desirable to fit the cars in such positions that the hull is always kept at some 5 or 6 ft. above the ground to allow for inequalities in the surface of the landing ground which might otherwise damage the hull structure while handling the ship on the ground. The reduction, however, of some 7 ft. in overall height compared with the Zeppelin system is, in practice, of considerable importance, due to the small size of existing shed accommodation. A third advantage is that the wing power cars, probably owing to their small size, are more efficient than the larger centre line cars. This is especially

the case with the large forward centre line car, which, as has already been stated, contains, besides the power car, a wireless cabinet and control car, and the resulting composite car is of necessity of such size that it somewhat blankets the propeller. In the case of the R 33 class, the lack of efficiency in the after car is probably to some extent due to the fact that it contains two engines and is of bad streamline form.

In the British system each car is used for its special function, and there is no loss of efficiency due to make a compromise. In this way each power car can be exactly the same, and only the slinging arrangements need be slightly varied.

It seems probable that for many years to come the machinery installation will be the most unreliable part of the ship during flight, and will, besides, require the most frequent overhauls and renewals. It is obviously equally important that both service and commercial rigids should be laid up for a minimum number of days per year and not for long periods as heretofore while their machinery is overhauled. Provision should, therefore, be rapidly developed whereby the power cars, as complete units, can be rapidly changed. No reason is seen, in the future, why such units cannot be so simplified that it will be possible, without actually taking the ship into the shed, to change one or more of the complete units. Besides providing standard power units, the separate parts such as the engine, transmission gear, etc., should be designed to be rapidly replaceable by new standard parts. Too great emphasis cannot be laid on the importance of standard power units.

(To be Concluded.)



#### Married

Flight-Lieut. AUBREY LAWRENCE LINGARD, B.A. Oxon, R.A.F., second son of Mr. and Mrs. F. C. Lingard, of Harpenden, Herts., was married on May 20 at St. John's, Sidcup to AUDREY MARGARET HEWITT, only daughter of Mr. and Mrs. Malcolm Hewitt, of the Bank House, Sidcup.

HENRY NORMAN TURNER, late Lieut., R.A.F., younger son of Henry Floyd Turner and Mrs. Turner, of "Beltinge," South Woodford, was married on May 19, at Christ Church, E. Sheen, to FRANCES GARBY, youngest daughter of Sir EDWARD NICHOLL, M.P.

#### To be Married

The marriage arranged between Flying Officer J. H. HUXLEY, D.F.C., and Miss FREDA FASCUTT will take place on Tuesday, June 1, at St. Mary Abbot's Church, Kensington, at 2 o'clock.

The marriage of Miss DOLLY LEVENE-DAVIS and Mr. CHARLES DE PINNA (late London Regt. and R.A.F.), will take place at the New West End Synagogue, St. Petersburg Place, Bayswater, on Tuesday, June 8, at 12.30 p.m.

The engagement is announced between GORDON BLEWS, ROBOTHAM, D.F.C. (late Capt., R.A.F.), eldest son of Mr. W. Blews Robotham, J.P., and Mrs. Robotham, of Littleover, Derby, and grandson of the late Sir Abraham Woodiwiss, and KATHARINE LILIAN, elder daughter of Mr. and Mrs. ARTHUR E. THOMAS, of Clifton, Bristol, and granddaughter of the late Mr. James Inskip.

The wedding of Sir FREDERICK SYKES, G.B.E., K.C.B., C.M.G., and Miss ISABEL LAW will take place quietly at 11 o'clock, on June 3, at St. Columba's, Church of Scotland, Pont Street, S.W.

#### Air Work in Russia

In the Bolshevik military report of May 19 it was stated:—

"Black Sea Front.—In the Sea of Azoff two enemy warships opened fire on the fort of Temriuk town, correcting their gunfire by the help of three aeroplanes. After our artillery answered their fire they made off in a north-westerly direction."

In the Bolshevik report of the following day the following appeared:—

"Our troops were assisted in crossing the River Beresina by a squadron of our aeroplanes, which bombed the enemy's positions. In the Vapniarka region . . . we captured an enemy aeroplane which had been brought down."

The Polish report issued from Warsaw on May 21 stated:—

"North of the Dniester the enemy re-attacked Krzyzezopol. Our infantry, however, supported by a squadron of aeroplanes, counter-attacked brilliantly and forced the enemy back for a distance of 12½ miles."

#### Independent Air Force R.A.F. Reunion

THE Annual Reunion Dinner will be held at the Savoy Hotel on Tuesday, June 15, 1920, at 7.45 p.m. for 8.0 p.m. The tickets, price 42s., may be obtained from F./Lieut. R. Addenbrooke-Prout, Room 763, Air Ministry, Empire House, Kingsway. Evening dress with miniatures, or uniform will be worn.

#### R.A.F. Voluntary Hospitals Closed

At a recent meeting of the general committee of the

Royal Air Force Voluntary Hospitals it was resolved that this organization should come to an end. Since 1915 the committee, with the patronage of Princess Christian and under the chairmanship of Sir David Henderson and later of Sir Thomas Berridge, has raised upwards of £120,000 for equipping and running hospitals and convalescent homes for officers of the Royal Air Force, nearly 5,000 of whom have received treatment during the past four years.

The surplus funds will be handed over to the Royal Air Force Memorial Fund Committee, formed on the initiative of Air Marshal Sir Hugh Trenchard, under the Presidency of Prince Albert, to be applied for officers and men of the Royal Air Force who may be disabled, sick, or otherwise infirm, and the hon. treasurer, Mr. Walter S. Field, will join this latter body to represent the funds.

#### Cricklewood Aerodrome Award

MR. EDWIN SAVILL, the arbitrator appointed to consider the claim of the Ecclesiastical Commissioners for £43,575 against the Ministry of Munitions in respect of the compulsory acquisition by the Ministry of the land on which the Cricklewood Aerodrome is built, has issued his award. It is to the effect that the amount of purchase money and compensation to be paid by the Ministry to the claimants for the purchase and for damage, injury, and loss suffered by reason of severance of such purchase land from the other lands, shall amount to £31,320. It was arranged that the question of costs should not be dealt with in the award, and it is therefore reserved.

# THE ROYAL AIR FORCE

London Gazette, May 18

## Permanent Commissions

The initials of Squad. Ldr. G. H. P. Padley (T.) are as now described, and not as stated in the *Gazette* of Aug. 1, 1919.

The notification in the *Gazette* of Aug. 22, 1919, appointing Lieut.-Col. R. E. M. Russell, C.B.E., D.S.O. (S.O.), *Gazette* of August 1, 1919, Lieut. A. H. E. Lindop (O.), and Lieut. R. W. Reid, M.C. (A.), to permanent comms. are cancelled.

## Short Service Commissions

The following offrs. have been granted short service comms. in the ranks stated. Except where otherwise stated, the comms. will have effect from May 18, and the offrs. will retain their seny. in the substantive rank last held by them prior to the grant of the short service commn.

In the case of offrs. now gazetted Flying Officer or Obs. Officer from Pilot Officer, seniority will date from the date of *Gazette* :-

**Flying Lieutenant.**—A. G. Taylor, A.F.C. (A.), with effect from May 10.  
**Flying Officer** (from Flight Lieutenant).—A. C. Sanderson, D.F.C. (A.), with effect from May 10.

**Flying Officers.**—F. C. Daniel (A.), H. C. Hawkins (A.), W. V. Hyde (A.), with effect from May 10. L. M. Iles, A.F.C. (A.), Flying Officer L. Martin (A.); with effect from May 17. R. E. Milne (A.); with effect from May 10. H. T. Pemell (Ad.), H. G. Sawyer (A.).

**Flying Officers** (from Pilot Officers).—M. H. Aten, D.F.C. (A.), P. R. Blythe (A.), E. Fulford (A. and S.).

**Obs. Officers** (from Pilot Officers).—A. Hesketh (D.F.C.), A. J. Redman, D.F.C.; with effect from April 26.

The notifications appearing in *Gazettes* of dates indicated appointing the following officers to short service comms. are cancelled:—Flying Officer W. K. Yarnold (T.); September 16, 1919. Flying Officer H. P. G. Leigh (T.); October 10, 1919. Flying Officer W. H. Golder, D.S.M. (T.), Flying Officer G. T. H. Pack (T.), Flying Officer S. Upton, (T.); October 24, 1919. Flying Officer W. H. L. Oxland (A.); December 5th, 1919. Flying Officer F. J. W. Hedgcock (T.); January 30.

## Re-seconding

Obs. Officer J. E. MacLellan (Lieut. Scot. Rif.) is re-seconded to the R.A.F. for two years, with effect from December 6, 1919. Flying Officer P. W. Smith (Ad.) (Lieut. R. Fus.) is re-seconded to the R.A.F. for two years, with effect from August 1, 1919 (substituted for notification in *Gazette*, April 27). The rank of Flying Officer A. E. Evans (A.) is as now described, and not as in *Gazette*, April 27.

## Flying Branch

Lieut. J. E. F. Bonnicksen is graded for purposes of pay and allices. as Maj. while empld. as Maj. (A.), from May 9 to 14, 1919.

**Sec. Lieuts. to be Lieuts.**—B. A. Bird (since demobilised), W. I. Crawford (since relinquished commn.); March 26, 1919. J. H. M. Woods; May 30, 1919 (since demobilised). H. Thomas; June 20, 1919.

**Pilot Officers to be Flying Officers.**—F. G. Edgington, T. F. Mathewson, A.F.C.; October 1, 1919. H. F. Luck; November 8, 1919. J. B. Hodgson; February 8.

Pilot Officer W. J. Tremellen (O.) to be Obs. Officer; March 4.

Pilot Officer (Hon. Flying Officer) A. H. J. Howlett (Lieut. Ind. Army) relinquishes his temp. R.A.F. commn. on reversion to Ind. Army; May 1. (Then follow the names of 16 officers who are transfd. to the Unemployed List under various dates.)

Lieut. J. H. Dunbar relinquishes his commn. on account of ill-health contracted on active service, and is permitted to retain his rank; Jan. 8 (substituted for notification in the *Gazette* of Jan. 10).

The following Sec. Lieuts. relinquish their comms. on account of ill-health and are permitted to retain their rank:—T. Stead (caused by wounds); May 8. R. S. McKenna (contracted on active service); May 11.

The notification in the *Gazette* of March 5 concerning Sec. Lieut. R. Foley is cancelled; *Gazette* May 20, 1919, to stand.

## Administrative Branch

Sec. Lieut. H. J. Thomas to be Sec. Lieut., from (T.); May 1, 1919, and is graded for purposes of pay and allowances as Lieut. whilst empld. as Lieut. May 1, 1919 (substituted for *Gazette* of Sept. 12, 1919).

**Pilot Officers to be Flying Officers.**—H. J. Thomas; Aug. 5, 1919. E. P. Dampier (since granted short service commn.), L. B. Lewis; Oct. 1, 1919. Squad. Leader G. Blatherwick is placed on half pay (Scale B) at his own request for three months, commencing from May 19.

(Then follow the names of 6 officers who are transfd. to the Unemployed List under various dates.)

Lieut. J. L. T. Davies (Lieut. R.W. Fus.) relinquishes his R.A.F. commn.; May 19, 1919.

## Technical Branch

Capt. G. R. Booth is graded for purposes of pay and allowances as Maj. while empld. as Maj., Grade (A.); May 1, 1919, to March 22 (substituted for notification in the *Gazette* May 4). Lieut. R. J. Anderson to be actg. Capt. while empld. as Capt.; April 1, 1918, to April 9, 1919 (substituted for notification in the *Gazette*, July 23, 1918).

**Pilot Officers to be Flying Officers.**—W. Cole, S. F. Coleman, L. E. Dowse, S. J. Edwards, F. Miller, P. R. Pratt, C. Reynolds, V. H. Wicks; Oct. 1, 1919.

**Pilot Officers to be Flying Officers** (Grade A.).—A. J. Brister; Oct. 1, 1919. H. B. Smith; March 23. N. F. S. Hecht; April 10.

**Sec. Lieut. (Hon. Lieut.)** I. M. Rodney to be Lieut. without pay and allowances of that rank; April 2, 1918.

**Pilot Officers to be Flying Officers** (without pay and allowances of that rank).—E. C. Farman, H. Sleigh; Nov. 3, 1919. F. Anderson; Feb. 4.

(Then follow the names of 10 officers who are transfd. to the Unemployed List under various dates.)

The notification in the *Gazette* of July 22, 1919, concerning Lieut. (actg. Capt.) F. A. Roberts, is cancelled; notification in the *Gazette* of April 27 to stand.

## Medical Branch

Flight Lieut. E. Haynes, D.C.M. (Capt. and Qr.-Mr., R.A.M.C.), relinquishes his temp. R.A.F. commn. on return to Army duty; April 27.

(Then follow the names of 2 officers transfd. to the unempld. list.)

## Physical Training Branch

Sec. Lieut. (Hon. Lieut.) (actg. Capt.) P. W. Smith to be Lieut.; March 26, 1919.

## Memoranda

Sec. Lieut. (Hon. Lieut. R. H. Smyth (S.O.) to be Lieut.; April 2, 1918. (Then follow the names of 37 cadets granted hon. comms. as Sec. Lieuts.)

London Gazette, May 21

## Flying Branch

Pilot Officer W. Coke-Gee (Lieut. I.A.R.O.) relinquishes his temp. R.A.F. commn. on reversion to I.A.R.O.; Feb. 2.

(Then follow the names of 26 officers who are transfd. to the Unemployed List under various dates.)

Lieut. R. C. Fyson (Suff. R., T.F.) relinquishes his commn. on account of ill-health caused by wounds, and is permitted to retain his rank; May 13. The following Sec. Lieuts. relinquish their comms. on account of ill-health contracted on active service, and are permitted to retain their rank:—D. McL. Ferrier, G. Holden, D. J. Wilks; May 14. The notification in *Gazette* of March 28, 1919, concerning Sec. Lieut. F. Jones is cancelled.

## Administrative Branch

Maj. N. G. Darnell is graded for purposes of pay and allowances as Lieut.-Col. whilst employed as Lieut.-Col., from May 1, 1919, to July 31, 1919; Capt. A. G. Macdonald is transfd. to the Unemployed List; April 14, 1919 (substituted for notification in the *Gazette* of April 27). Sec. Lieut. W. Campbell relinquishes his commn. on account of ill-health contracted on active service, and is permitted to retain his rank; April 25.

## Technical Branch

Sec. Lieut. R. McL. Freemantle, M.B.E., is graded for purposes of pay and allowances as Capt. whilst employed as Capt., Grade (A), from May 1, 1919, to Sept. 17, 1919 (substituted for notifications in the *Gazette* of Sept. 12, 1919, Oct. 14, 1919, and April 27). Pilot Officer W. H. Golder to be Flying Officer; Oct. 1, 1919.

(Then follow the names of 9 officers who are transfd. to the Unemployed List under various dates.)

Lieut. C. J. Hallward relinquishes his commn. on account of ill-health, and is permitted to retain his rank; May 14. Lieut. R. H. Bright (Sec. Lieut., Gen. List) relinquishes his temp. R.A.F. commn. on retirement from the Army, and is permitted to retain the rank of Lieut.; May 22.

## Medical Branch

Flying Officer J. Fanning to be Flight Lieut.; May 19. One officer transfd. to the Unemployed List.

## Memoranda

(Then follow the names of 47 Cadets granted hon. comms. as Sec. Lieuts.)  
Flight Lieut. G. Palmer, M.B.E. (Maj. and Qr.-Mr., Devon R.), relinquishes his temp. R.A.F. commn. on return to Army duty; May 10.

(Then follow the names of 2 officers transfd. to the Unemployed List under various dates.)

Sec. Lieut. V. P. A. Lawerenson relinquishes his commn. on account of ill-health and is permitted to retain his rank; May 13. Hon. Sec. Lieut. A. M. Paterson-Brown relinquishes his commn.; Jan. 30.

## The H.P. Continental Services

DURING the period from September 2, 1919, to May 15, 1920, the Handley Page Continental Services (in conjunction with Cie. Messageries Aériennes) carried 1,413 passengers, 79,317 lbs. of freight and travelled 104,297 miles.

## Capt. Matthews going to Australia

FROM a cable message received from Capt. Matthews from Java, it appears that Capt. Matthews has succeeded in salving the engine and a good deal of his Sopwith Wallaby. He is having them packed up and sent to Australia and hopes to be able to fly again when he obtains new planes. He attributes the accident to temporary failure of the fuel supply.

## The Blériot Safety Prize

THE Aviation Committee of the Aero Club of France has now approved the regulations for the Louis Blériot Safety Prize. The prize of 100,000 francs will be awarded to the competitor, who, under certain conditions, makes the slowest vertical speed in descending from a height of 500 metres and lands in a circle 50 metres in diameter.

## The Memorial to Senator Reymond

ALTHOUGH at the time of writing the reports as to the condition of the French President are somewhat disquieting,

it is sincerely to be hoped that he will quickly recover from the effects of his accident. M. Deschanel, when he fell from his special train near Montargis was on his way to unveil the memorial at Montbrison to Senator Dr. Reymond, who, when war broke out, at once joined up as an aviator, although he was 49 years of age, and did very good work, until he was shot down and killed in October, 1914. In the absence of M. Deschanel, the memorial was unveiled on May 24 by M. Steeg, the Minister of the Interior.

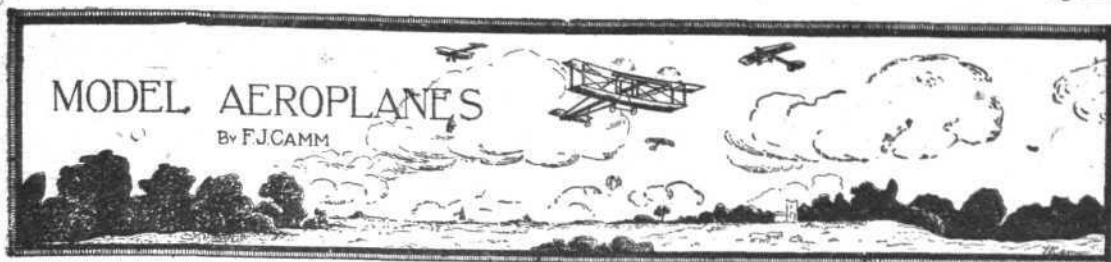
## Testing the New Fokker Limousine

THE new Fokker Limousine monoplane, with cantilever wings, was put through some tests at Amsterdam on May 17, but no details are obtainable as to the results, although the trial flights are said to have been successful.

## M. Taddeoli Killed

SWISS aviation has lost a notable exponent in M. Taddeoli, who was drowned on May 24, while flying over Lake Constance off Romanshorn. While making a spiral dive, his Savoia biplane collapsed and fell into the lake from a height of 1,200 feet. M. Taddeoli and his mechanic, M. Giovanelli, were strapped in, and so were dragged to the bottom of the lake.





NOTE.—All communications should be addressed to the Model Editor

### Wood for Models

I SHOULD like to point out that for the stouter frame-members of large models, spruce is quite as suitable as harder woods, and is considerably lighter. In case readers should have any difficulty in obtaining a reference to a table of cubic weights of timber, I give below a list of suitable woods, with the weights per cubic foot. This list is a portion of a valuable table given by Sir Hiram Maxim in his work "Artificial and Natural Flight."

(1) Lancewood .. ..	45 lbs. per cubic ft.
(2) Honduras Mahogany ..	35 " "
(3) Birch .. ..	45 " "
(4) Maple .. ..	46 " "
(5) Spruce, Canadian ..	31.25 " "
(6) " Norway ..	32 " "
(7) Bamboo .. ..	25 " "

The table is arranged in the order of relative strengths; thus, No. 1 Lance-wood comes at the top. It is very flexible and tough, but very expensive.

Honduras mahogany comes next, with a high tensile strength, but rather brittle.

Then we have birch—a very tough wood with a fairly high strength.

Maple is about equally as strong and tough, but rather heavier.

Spruce ranks next, with a slightly lower strength—but having the advantage of being much lighter, being in fact little more than two-thirds of the weight of the two last—making it more suitable for large frame members, such as skids, etc.

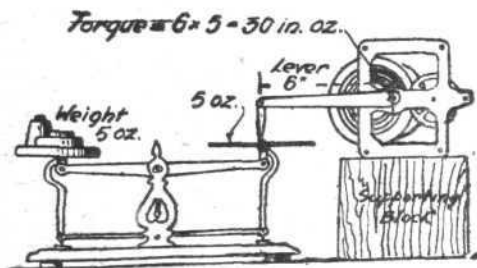
Bamboo is very light when used in its natural form for large work, and is very weak; but when split up for models it is rather heavy, and very elastic. Some authorities advocate it; but my objection to it is that it cannot be cut to neat shapes; and, moreover, it cannot be so neatly jointed as can the woods.

### Airscrews

The model airscrew cannot be considered in the same light as full-size ones. In the first place, the revolutions of a rubber-driven screw commence to drop directly the machine is launched, owing to the torsion and torque diminishing from that moment. The efficiency, therefore, is gradually improving, because at lower revolutions the slip-percentage will be less, and less power will be lost, therefore, in the setting up of wasteful eddies. This fact renders model airscrew design extremely difficult; moreover, whereas with model screws the chordal line of the blade intersecting the axial line gives the pitch angle, full-size screws are not so calculated. Again the fact that many full-size screws do not have radial blades alters the proposition in many ways. For these reasons my statement that the static thrust of a model can also be taken as the aerodynamic thrust holds good—and it is borne out by actual practice.

### Measuring Thrust

Thrust is arrived at in this way. The actual torque or turning force at the shaft is measured as shown in the illus-



MEASURING TORQUE

tration; a clockwork motor is there shown, but the same method also applies to rubber-motors. This torque, assume, is 30 inch-ounces. Next decide on the screw-diameter and pitch—say, 12 ins. diameter and 18 ins. pitch. If the motor will stand 500 turns, theoretically it will fly 750 ft.

Thrust will be found from the formula:  $T = \frac{t A}{R}$

Where T = thrust in ounces.

t = torque at shaft in inch-ounces.

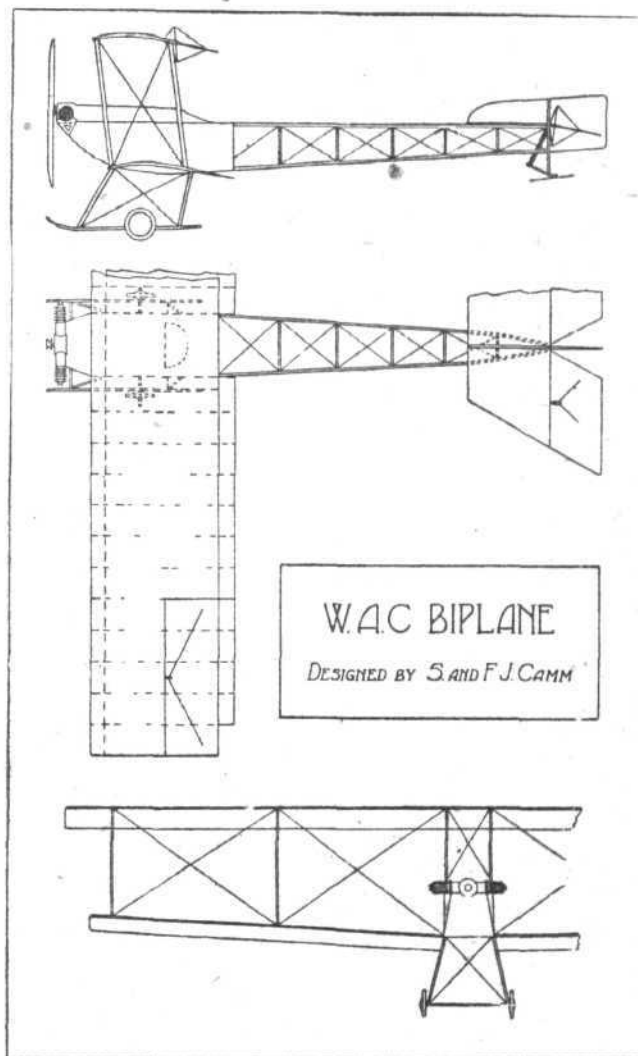
A = pitch angle at tip of screw.

R = radius of screw in inches.

Therefore thrust will be  $\frac{30 \times 2.09}{6} = 10.2 \text{ oz.}$

### The W.A.C. Biplane

I here set on record the drawings of the full-size tractor biplane built by the Windsor Aero Club, with which I was erstwhile associated. One reflects back, in moments of reminiscence, with thoughts of pleasure not altogether unintermingled with ones of sorrow of those old club days that merely mark a milestone in one's career.



They were interesting days, every second of which I thoroughly enjoyed, those days of Twining, Clarke, Aston, etc.

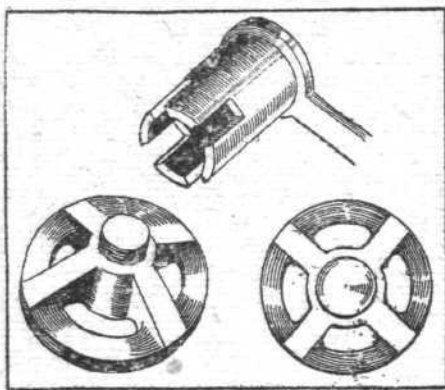
It is regrettable that few of the present clubs touch upon the subject of gliders, although many certainly do make a scientific study of models.

However, the machine here shown was driven by a twin horizontally-opposed two-stroke Avro engine, made by the Cowly Co. (of Bolton, I think). The machine was made exceedingly light, as an instance of which it may be stated that the fuselage portion abaft the pilot's seat complete with tailskid and rudder post only weighed 11 lbs., but to this day remains as true as when first aligned up. I should be glad, by the way, to receive those club histories anent which I recently made reference.

## THE "WEB" NUT

THE ordinary hexagon nut is such a common object that few people give a thought as to whether it is the last word on the subject. As a matter of fact, Messrs. Herrtage, Holyoake and Co. have brought out an improved nut for which several advantages are claimed, especially for use in connection with aircraft. The general arrangement of the "Web" nut, as it is called, can be gathered from the sketch. It consists of a barrel with a flange at the lower end, and four webs arranged at right angles. The webs permit of the nut being screwed up or loosened by means of the special spanner, which is simply a short tube (with slots to fit the webs) attached to a handle, and the positive grip which is obtained makes the nut much easier to tighten or slacken than is the ordinary nut.

It will be noticed four slots are cut between the webs. Apart from the fact that this lightens the nut to a certain



The "Web" Nut put on the market by Messrs. Herrtage, Holyoake and Co.

extent, it also permits of the nut performing the double function of nut and lock-nut. When used on metal it is claimed that slight oxidation is permitted opposite the slots, and this is sufficient to prevent the nut working loose. Again, when used on wood, the nut when screwed up allows the wood to swell into the slots just sufficiently to hold the nut and prevent it turning. As the nuts weigh less than those of ordinary design, and in ordinary cases render the use of a lock-nut unnecessary, it is possible to save a considerable weight by their use. The nuts are made in a wide range of sizes, and Messrs. Herrtage, Holyoake and Co., of 127-128, Fleet Street, London, E.C. 4, will be pleased to quote for any quantity. They also supply the necessary spanners, which can be had either with the bar handle or with a "tommy" bar handle.

### Aeroplanes for Rumania held up

ACCORDING to the *Gazzetta del Popolo* a train carrying French aeroplanes given by the French Government to Rumania has been held up at Brescia railway station by the railwaymen, the reason advanced for this action being a fear that the machines were to be used in an offensive against the Bolsheviks. Up to the present no word has been received that the trucks containing the aeroplanes have been allowed to leave Brescia.

### The Rome-Tokyo Flight

LIEUT. FERRARIN arrived at Peking from Tsing-tao on May 17, and received a decoration conferred by the President of China, while the Chinese aviation department presented him with a silver incense burner. Lieut. Ferrarin on May 23 flew to Kowpantze, and later the same day landed at a town in the north-east of Korea.

### An Air Race in 'Frisco

THE race flown on the opening day of the San Francisco Aeronautical Show for the Del Monte Trophy marked another triumph for British aircraft and aero engines, having been won easily by a "Bristol" two-seater tourer fitted with a 230-240 h.p. Siddeley Puma engine. The Bristol made an excellent start, and from the early stages of the 220-mile race displayed its marked superiority over its rivals. Flying without a hitch it completed the course in 102 minutes, an average speed of 129 miles per hour. The machine had recently been acquired by Mr. Menzel of California through the New York branch of the Bristol Aeroplane Co., Ltd., of Bristol, England.

## PUBLICATIONS RECEIVED

*The Year Book of Wireless Telegraphy and Telephony*, 1920. London: The Wireless Press, Ltd., 12-13, Henrietta Street, Strand, W.C. 2. Price 10s. 6d.

*Report of the Canadian Air Board for the Fiscal Year ending March 31, 1920.* The Air Board, Ottawa, Canada.

*A Primer of Air Navigation.* By H. E. Wimperis, M.A. (Cantab.). London: Constable and Co., Ltd. Price 8s. 6d. net.

*Eastern Nights and Flights.* By "Contact" (Alan Bott). Edinburgh: Wm. Blackwood and Sons, 45, George Street. Price 7s. 6d. net.

*Australian Meteorology.* By Griffith Taylor, D.Sc. Oxford: The Clarendon Press. Price 12s. 6d. net.

*Metals in Aircraft Construction.* By Wilfred Hanby. London: The Standard Air Press, Ltd., 3 and 4, Lincoln's Inn Fields, W.C. 2. Price 6s. net.

*Report No. 69. A Study of Airplane Ranges and Useful Loads.* National Advisory Committee for Aeronautics, Navy Building, 17th and B. Streets, N.W., Washington, D.C., U.S.A.

### Catalogue

*Aerial Guiding and Landing Lights.* Chance Brothers and Co., Ltd., Lighthouse Works, Smethwick, Birmingham.

## AERONAUTICAL PATENTS PUBLISHED

Abbreviations: cyl. = cylinder; I.C. = internal combustion; m. = motor

### APPLIED FOR IN 1915

Published May 27, 1920

17,157. RANKEN. Darts for use from aircraft.

### APPLIED FOR IN 1916

The numbers in brackets are those under which the Specifications will be printed and abridged, etc.

Published May 27, 1920

13,760. H. L. d'E. SKIPWITH and others. Wireless signalling. (142,141.)

### APPLIED FOR IN 1917

Published May 27, 1920

17,497 and 17,498. T. E. RICHARDS, Hangars. (142,154 and 142,155.)

19,565. C. A. CLEGHORN and GAYNER PNEUMATIC CO. Balloon fabrics. (142,160.)

### APPLIED FOR IN 1918

Published May 27, 1920

1,423. J. G. GRAY. Electro-magnetic steering apparatus. (142,164.)

5,960. A. G. ANDREWS. Device for protecting eyes and face. (142,240.)

8,461. W. R. BUTLER. Gyroscopic level. (142,261.)

10,266. S. YANO and W. HALL. Radial or rotary engines. (142,287.)

16,772. J. D. MACKWORTH and E. G. WALKER. Inflation systems for non-rigid aerostats. (142,356.)

16,840. L. C. BYGRAVE. Course and position indicators. (142,357.)

18,772. C. ROY. Process for rendering wood impermeable. (130,981.)

22,773. G. CAPRONI. Seaplanes, etc. (132,797.)

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